# MEXICAN WEST COAST
AND
# LOWER CALIFORNIA
## A COMMERCIAL AND INDUSTRIAL SURVEY

UNITED STATES DEPARTMENT OF COMMERCE
BUREAU OF FOREIGN AND DOMESTIC COMMERCE

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DEPARTMENT OF COMMERCE
BUREAU OF FOREIGN AND DOMESTIC COMMERCE
JULIUS KLEIN, Director

SPECIAL AGENTS SERIES—No. 220

# MEXICAN WEST COAST AND LOWER CALIFORNIA

## A COMMERCIAL AND INDUSTRIAL SURVEY

BY

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Trade Commissioner
and
H. BENTLEY MACKENZIE
Assistant Trade Commissioner

With the assistance of American Consuls Francis J. Dyer (Nogales) Bartley F. Yost (Guaymas), and W. E. Chapman (Mazatlan)

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LANCASTER, PENNSYLVANIA

# LOWER CALIFORNIA

AND

# MEXICAN WEST COAST

A COMMERCIAL AND INDUSTRIAL SURVEY

BY

A. L. BEAT

AN

ADDRESS BY AMERICAN AND MEXICAN COMMERCIAL OFFICIALS

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DEPARTMENT OF COMMERCE

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## LETTER OF SUBMITTAL.

DEPARTMENT OF COMMERCE,
BUREAU OF FOREIGN AND DOMESTIC COMMERCE,
*Washington, April 16, 1923.*

SIR: There is submitted herewith a commercial and industrial survey of the Mexican "West Coast" and the peninsula of Lower California, by Trade Commissioner P. L. Bell, Assistant Trade Commissioner H. Bentley MacKenzie, and American Consuls Francis J. Dyer, Bartley F. Yost, and W. E. Chapman. The monograph is similar in plan and scope to Mr. Bell's previously published handbooks of Colombia and Venezuela—Special Agents Series Nos. 206 and 212.

Extraordinary difficulties were encountered in the collection of proper material and in the writing of the report, because of unsettled conditions in Mexico. Only the investigators' personal knowledge of the coast territory enabled them to prepare as thorough a discussion of the region as is here presented. Trade Commissioner Bell's long residence on the West Coast of Mexico has made it possible for him to select material judiciously, to collect and elaborate on the mass of miscellaneous data obtained from all sources, and to bring out the features that are fundamentally important.

Special acknowledgment is made of the services of the American consulates, which for the past 10 or 11 years have been the only agencies active in the collection of authentic economic and commercial information on the West Coast. Without their aid and cooperation and the use of the data gathered by them the present work would of necessity have been relatively meager.

Mr. Bell desires to give particular credit also to the work of the commodity divisions of the Bureau of Foreign and Domestic Commerce in collecting reports on various articles that are commercially important on the Mexican West Coast and of interest to American exporters. He calls attention to the fact that every important line has been covered by questionnaires sent to the consuls by the various commodity divisions, and that there is available, in addition, a wide range of special reports and correspondence.

For 60 years the people of the Pacific coast of the United States have been keenly interested in the development of mining throughout the West Coast region of Mexico; and, since the construction of the Southern Pacific Railroad of Mexico down the coast from Guaymas, there has been a heavy investment in the agricultural development of the potentially rich river valleys.

It is believed that the principal value of this report will be found not so much in its strictly commercial aspects but rather in the treatment of the natural resources of the region and their development. For this reason special attention has been given to the consideration of land and mines.

Respectfully,

JULIUS KLEIN, *Director of Bureau.*

To Hon. HERBERT HOOVER,
*Secretary of Commerce.*

# MEXICAN WEST COAST AND LOWER CALIFORNIA.

## Part 1. THE WEST COAST.

### INTRODUCTION.

#### RELATION TO PACIFIC COAST OF UNITED STATES.

The limits of the "West Coast" of Mexico, as the term is used in this monograph, are defined on page 9. The greater importance of this district to Americans, as compared with other regions of Mexico, lies in its geographic position, contiguous to the rapidly developing southern part of the Pacific coast of the United States. It is important not so much as a commercial market for American products but rather as a field for investment in mining, lands, and other enterprises. The West Coast of Mexico has the same enormous mountain areas as the western United States, with notable mining interests; similar valleys, with rivers carrying sufficient water annually to irrigate all the available fertile lands of the various watersheds; similar prolific fishing banks on its coast; and about the same market conditions, given adequate transportation facilities. In fact, the people of the southern half of the Pacific coast of the United States have regarded the West Coast of Mexico, ever since the construction of the Southern Pacific of Mexico Railroad south from Guaymas in 1909, as "pioneer" territory, and its development by them has been retarded and delayed only by the conditions existing in Mexico for the past 11 years, and latterly (since the return of fairly peaceful conditions in Mexico during the past year and a half) only by the present features of Mexican legislation, which precludes development by foreigners to a very great extent, chiefly in relation to land development and colonization enterprises, in which undoubtedly lies the future of the West Coast of Mexico, whatever may be said regarding the importance of the mining industry.

However, both commercially and agriculturally, the territory in question has its limitations. A large portion of the area is eliminated from any agricultural development on account of its more or less broken topography, and by far the greater part of the remainder of the more or less level regions has no available water for irrigation of the good lands that might otherwise be eventually improved. A summary of this situation, treating the area of the West Coast as a whole—that is, from the mountain ridge line to the coast—shows hardly one-tenth of the total surface area suitable for cultivation, and only on one-tenth of this latter area are conditions right for intensive cultivation.



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## POSITION OF TERRITORY AS MARKET FOR AMERICAN GOODS.

Commercially, the value of the West Coast of Mexico as a prospective market for American goods is limited by the fact of its sparse population, which totaled only about 760,000 people in the three States of Sonora, Sinaloa, and Nayarit according to the census of 1910, and this population has since been somewhat decreased by emigration during the past 10 years. This decrease in numbers has been caused by the same factors that have brought about the decrease in the average per capita wealth of the people inhabiting this territory. However, it is a fact that certain factors of development, principally the rapid increase in the planting of winter fruits and vegetables for the American market and the gradual reopening of the mining industry, will shortly make the West Coast better commercial territory for export than it has been for the past few years.

As a foreign market, the West Coast must be measured by the same standards of average purchasing power per capita as the rest of Latin America, where the same degree of development obtains at present, and this standard average is lower than the per capita average in the United States. The exception to this rule on the Mexican West Coast is in the large mining camps, such as Cananea, etc., where industry and labor have become quite highly specialized and the average remuneration is much higher than elsewhere in the territory under discussion. Any large increase in the sale of merchandise on the West Coast of Mexico will come only with an increase in population, and this means immigration and settlement.

Settlement and development proceed along what sometimes appear to be erratic lines, but, when thoroughly analyzed, curves of growth in population and production are apt to have an entirely reasonable base and to work out under certain inexorable natural laws. A very good example may be cited in the development in the past of the southern portion of the State of Sonora and the States of Sinaloa and Nayarit. As long as the easiest means of communication was that from San Francisco by water to the port of Mazatlan or of Guaymas—and exploration and development had to be at long range, with few facilities for making them really effective—development, except in mining, was slow; but the construction of the Southern Pacific line south from Guaymas along the coast, which was begun in 1909, changed all this, with daily trains through from the American border at Nogales, Ariz., and through Pullmans from Los Angeles to Tepic, in Nayarit; and the foundation was laid for a permanent agricultural and industrial development by Americans which has been delayed only by the political conditions existing in Mexico for the past 11 years.

This same factor of rail transportation has brought about great changes in the international commerce of the West Coast of Mexico, as well as on the West Coast itself (in the way of transferring commercial centers of activity). Los Angeles, the metropolis of southern California, was able to compete commercially with San Francisco as an export center for the Mexican West Coast. On the coast itself, Mazatlan has become the unrivaled commercial center, with Guaymas correspondingly depreciated as a port and center of business, and with Manzanillo remaining only a port of transshipment to and from the interior of Mexico.

## LAND DEVELOPMENT FROM STANDPOINT OF AMERICAN INVESTORS.

However, most of this early development of 10 to 15 years ago was manifested by the purchase of large tracts of good land by wealthy American investors interested in the eventual profit from cheap acreage. Their colonization efforts would have resulted in an increase of the agricultural population of the West Coast, but any such increase would not have been, and could not be, adequate until such time as the pressure for more land becomes greater than it is to-day in our extreme West. Observation of such development in the past shows that it is always slow and contemporary with an increase in population in other areas containing good lands. As an example, the development of the Imperial Valley in southern California may be cited here. Water was provided by the Colorado River irrigation system in 1901. Since then it has taken 21 years to put a total of 435,000 acres under intensive cultivation on the American side of the valley and approximately 200,000 acres on the Mexican side. With the building of the proposed Boulder Canyon Dam up the Colorado, an additional 1,200,000 acres of good land will come under irrigation on the American side in the Imperial Valley alone, not to mention another million acres on the Mexican side of the valley and the additional acreage created farther up the Colorado River Basin. At the rate of less than half a million acres put under cultivation in 20 years, it will take at least 50 years (and possibly much longer, depending on general conditions) to absorb the available lands in the United States alone. In view of the semitropical climate of the West Coast of Mexico, its large proportion of Indian population, the present property-ownership laws of Mexico (which so directly affect foreigners), and the unstable conditions in Mexico during the past 11 years, it is apparent that, even considering the lower first cost of the land itself, any very rapid development by settlement of the West Coast of Mexico can not be judiciously predicted at this time—the probable period to be covered being, one may say, the next 50 years.

Colonization efforts by the owners of large tracts of irrigated lands will help, of course. Something has already been done in this way for the West Coast, and much more would have been done by this time but for the interruption of the years of disturbed conditions in Mexico. However, the problem as a whole will be of slow and gradual solution.

The present activity on the West Coast in the production of winter tomatoes and vegetables by Americans for the American market is helping in this development and may prove to be a permanent industry on a large scale; but, like California, the West Coast must develop other products of consumption (such as the citrus fruits of southern California), not only for the consumption of the most thickly populated part of Mexico but also for export.

Increase in population is essential, and this increase must come from regions other than Mexico itself. It is not generally thought, either by native Mexicans or by foreigners, that this necessary immigration to the West Coast can or will come from the interior of Mexico, where 70 per cent of the population is concentrated, because there is sufficient good land in the interior to support the present population in normal times and under normal conditions; because the native Mexican of the agricultural class does not possess

the pioneer spirit or landowning desire to a very great degree, being also economically unprepared to take advantage of low-priced lands; because the people of the highlands of the country will not go to the lowlands of the coast on account of the heat and fever; and because there are several very good agricultural regions, still only partly developed, much nearer the centers of population in Mexico. The agrarian problem in Mexico, with the exception of a few districts inhabited by Indians, is not one of lack of good lands for the people, but rather one of educating the existing population in better methods of production and also of instilling the idea of land and home owning.

Another important factor in the future development of the West Coast of Mexico, and one which is to be taken into serious consideration by the interests owning large tracts of undeveloped but easily irrigated land there, is that of the rapid increase of the class of tenant farmers in the Middle West of the United States, where the land has become too valuable and high in price to allow of purchase outright; it is reasonable to suppose that this class of farmer, knowing good land, will be attracted by the price of $10 to $20 per acre at which he can secure land on the West Coast of Mexico with water available, which will insure to him a competence, with the additional prospect of increase in land values as time goes on. From this class a fair portion of buyers can be found as soon as conditions in Mexico itself may warrant their being attracted to this territory through colonization work in the United States by those interested in the development of raw-land acreage on the West Coast.

## NECESSITY OF MARKET OUTLETS FOR PRODUCTS.

To-day, the one vital and most necessary thing for the West Coast of Mexico is the extension of the Southern Pacific Railroad line to connect with the National Railways of Mexico at Guadalajara, and thus afford direct communication between the West Coast and the most populous part of Mexico, where 70 per cent of the country's people are congregated in the central region, in and around the capital. Lacking sufficient consumptive capacity at home on account of the small population (with a potentially high agricultural production, which can be greatly increased even with the present population), the West Coast lacks an adequate market outlet for its products. Rice, wheat, corn, and "garbanzos" (chick-peas) can not be shipped to the United States, as the first three products named can not compete with the domestic production of this country and the last named is not sufficiently well known in the United States to be a staple article of diet. Overproduction and crops on hand from harvest to harvest have been the result for the West Coast, at the same time that the central part of Mexico has lacked a sufficient staple food supply. In consequence, the West Coast has witnessed the great and increasing planting of winter tomatoes and vegetables for the American markets, where high prices and a ready demand have been found.

The necessity is that of market outlets for products, and the extension of the Southern Pacific Railroad of Mexico to the National Lines at Guadalajara would furnish this market outlet until such time as the central part of Mexico again begins to produce an adequate food supply. After that, as has already been mentioned,

the West Coast must develop a product of export such as the citrus products of southern California. This development means, of course, highly specialized industry and competition in the world's markets with California, Florida, Spain, Italy, Cuba, Porto Rico, etc. On account of the lack of sufficient population, of sufficient capital, and of experience in the production and marketing of highly specialized products such development means one thing for the West Coast—American capital and immigration. This condition is beginning to be fully realized by the people of education and enlightenment on the West Coast, who will welcome and emulate such development by Americans, as they are now doing in the new industry of winter tomatoes and vegetables.

## CONDITIONS SIMILAR TO THOSE IN SOUTHERN CALIFORNIA.

In further analysis of the West Coast of Mexico and its prospects of future development, it is again necessary to return to the comparison with southern California. The State of California possesses approximately the same area as the territory called the "West Coast," California having 155,980 square miles as compared with 154,000 square miles in Sonora, Sinaloa, Nayarit, and a small part of Durango—all within the zone of influence of the Southern Pacific of Mexico Railroad down the West Coast. In California 12 per cent of the total area is more or less thoroughly cultivated and irrigated. Southern California, with its wonderful production of citrus fruits, vegetables, nuts, dried fruits, dairy products, olives, dates, etc., had an area of only slightly more than 200,000 acres in use in 1909, exclusive of the Imperial Valley.

As regards topography, climate, native races, and history, the development of the West Coast of Mexico presents almost an exact parallel to that of California. The similarity is explained in detail on page 97.

## MEASURES CALCULATED TO STIMULATE ECONOMIC PROGRESS.

In 1908 the Mexican Government began to pay particular attention to development. Meteorological stations were established and bureaus created. Experts were sent to the United States to study American methods of weather reporting, agricultural development by Government aid, etc. Concessions were granted on the West Coast conveying the rights to the use of 123,280 liters per second of water for power purposes and 40,000,000 liters for irrigation. The Yaqui Valley irrigation project was carried out. A number of private canals were constructed in the Mayo Valley. The irrigation system of the Fuerte Valley was constructed by the United Sugar Co. A number of private and small-company irrigation canals were put in operation in the Sinaloa River Valley. A large irrigation scheme was carried out in the Santiago Valley in Nayarit. Latterly the Canal Rosales was constructed by Gen. Angel Flores in the Culiacan Valley. In addition, there has been the development of new lands under irrigation by the various sugar companies. Mention should also be made of the Canal Cañedo, constructed in the Culiacan Valley by the Sinaloa Land & Water Co. for their lands of the Yevavito hacienda.

It is doubtful whether any equal amount of money has produced greater results in civilization and modern progress than the 40 to 50 millions of dollars spent by the Southern Pacific Co. in the construction of its West Coast Line. Isolated communities, in which the results of intermarriage, want of spirit, disease, and lack of outside contact were only too apparent, were awakened and began to get into step with modern progress until this influence was thwarted to a great extent by the revolutions, when the benefit of improved material conditions (which go hand in hand with education, sanitation, and development of the moral qualities) diminished for a time.

## AGRICULTURAL ADVANTAGES OF REGION.

It has been said that the future of the West Coast territory of Mexico lies in agricultural development. It is a fact that the world's available supply of arable lands is being so rapidly absorbed that 10 years more will see the limit in the North American Continent, with the exception of such lands as can be developed by such projects as that of the proposed Boulder Canyon Dam on the Colorado. When the Southern Pacific was engaged in extending its line down the West Coast, a land boom was started from California, which, if it had not been stopped by revolution and adverse legislation in Mexico, would probably have equaled in 10 years the settlement and development of southern California.

The great advantage that the irrigable areas of the West Coast of Mexico possess over other agricultural districts is that the rivers during their flood periods carry large amounts of silt, which constantly renews the soil. Many other previously fine producing areas are annually dropping off in their production on account of gradual soil depletion, while on the West Coast the opposite is true, because soil improvement goes on as cultivation progresses.

The Panama Canal has greatly shortened the distance by water to the markets of the world, so that shipments of sugar, fruits, cereals, fibers, metals, etc., can compete with California and the Pacific Coast States of the United States in eastern and European markets. The distance from Mazatlan to the canal is 1,810 miles and from Colon to New York 1,989 miles. California is now shipping its citrus fruits, dried fruits, and other products to the eastern seaboard of the United States by water and has been forced to take full advantage of the cheaper water rates in order to be able to compete in our eastern markets with Italian shipments of similar products.

The West Coast of Mexico has a number of fairly good harbors, such as Guaymas, Topolobampo, Mazatlan, San Blas, and Manzanillo. Topolobampo is a fine natural "fjord" harbor, and the settlers in the Fuerte Valley possess the great additional advantage of both rail and water transportation.

Commercially the West Coast of Mexico represents a unit of that country worth, by comparison, one-twentieth of the rest of the country as a market at the present time for American products. Its great importance lies in its lands situated in its river valleys and subject to irrigation, as has been pointed out. Its importance as a commercial territory will increase only in direct ratio to its agricultural development, and this development must come with the

investment of American capital and by means of immigration and settlement from the United States, carried out with the same spirit and made necessary by the same economic fundamentals as in the case of southern California.

### EXPECTED INCREASE IN PURCHASING POWER.

With mining relatively stagnant, cattle resources depleted, and only the recent development of the tomato and winter-vegetable industry for the American market holding out hopes for a renewed influx of circulating medium, in face of the limited market for such West Coast staples as corn, beans, and "garbanzos," the West Coast of Mexico does not present an attractive field for immediate commercial sales work on the part of American houses new to the territory or with limited capital or foreign-trade experience. It is true, however, that the West Coast will take, during the fall, winter, and spring months of 1922–23 approximately three times the total amount of imported merchandise taken during the preceding year, or year and a half, because of a combination of circumstances such as the final disposal of the previous year's "garbanzo" crop, the good wheat crop in Sonora, the corn and bean crop to be harvested in December in Sinaloa, and the large increase in tomato and winter-vegetable acreage, which may be said to be three times that of the preceding year in Nayarit and four times that of the preceding year in Sinaloa and Sonora. Much of this expected increase in purchasing power must go to taking care of a considerable volume of old accounts long overdue, which were held over on account of the partial crop failures in Sinaloa in corn and beans during the seasons of 1920 and 1921 and the general economic depression that has been felt all over Mexico since the middle of 1921.

### NEED OF ADDITIONAL BANKING FACILITIES.

The greatest need, next to the extension of the railway to Guadalajara, is adequate commercial and agricultural banking facilities, and nothing would do more to forward American commercial and investment interests on the West Coast than the establishment of a branch American bank at Mazatlan, with branches and agencies up and down the coast, but, in view of the recent past history of banking in Mexico, the present unfavorable legislation, the lack of adequate regulations relating to financial institutions in the country, and other factors involved more or less in the present political and financial condition of the Government itself, it is difficult to see just how such a bank could be established at the present time despite the urgent need for its services and the undoubtedly favorable prospect of profit to the capital so invested.

### PRESENT POSITION OF AMERICAN INTERESTS—OPPORTUNITIES FOR FUTURE.

A careful survey of the commerce and trade of the West Coast under present conditions shows that American firms already have secured what amounts to practical monopolies of the existing demand in their lines. Germany has not succeeded recently in doing anything worth while in a commercial way in this market notwithstanding

all reports of German competition, and it may be easily predicted that the San Francisco and Los Angeles firms already well established with the trade will continue to enjoy their share of the business and reap the benefit of the coming better conditions.

Immediate opportunities in the extension of trade with the West Coast of Mexico lie in the introduction there of a number of specialties now manufactured in California for the Pacific coast trade, which have been developed in consequence of the similar conditions existing in California.

American mining companies are endeavoring to take advantage of the existing conditions to secure likely new and old properties, and the entire coast and adjacent mountain territory is being carefully "prospected" by competent engineers. It may be predicted, so far as the future of the mining industry on the West Coast is concerned, that on account of its lesser development in the past the State of Nayarit will be the scene of the greatest mining activity in the near future. This territory is now attracting greater attention, and more surveying work is being done there.

Immediate opportunity also exists in the cedar and pine lumber industry on the West Coast. Cedar from Nayarit is now being manufactured at Nogales, Ariz., by an American company, and accessible tracts of merchantable pine exist, as well as of a species of black oak in a restricted area.

Possibly the greatest opportunity lies in the development of banana plantations along the coast south of San Blas, Nayarit. It has been demonstrated since 1912, when the first Costa Rican plants were imported, that the banana of commerce will grow successfully in the frostless belt along that part of the littoral, although production is not so rapid as in Central America and Colombia on account of the drop in temperature during the three winter months, retarding the development of the fruit. The market exists on the Pacific seaboard of the United States. However, as regards this industry it is universally believed by experienced people and by those who have had the opportunity of observing the banana industry elsewhere that such an undertaking is not practical on a small scale or by inexperienced people. Ships equipped with refrigeration are necessary; production on an adequate scale is also necessary; and there remains the very important factor of market and distribution organization in the United States or that part of the American territory to be covered. Attempts on a small scale are now being organized.

In conclusion it may be said that the West Coast of Mexico is very well known by a large number of American agriculturists, land men, mining engineers, merchants, and business men on the Pacific coast of the United States; that a great deal has been written in description of the resources, industries, and possibilities of the West Coast region served by the Southern Pacific Railroad of Mexico; and that there is a great interest in the development of that territory on the part of the American people of our Pacific coast. Reciprocally, the Mexican people of all classes on the West Coast have had a very considerable contact with southern California during the past 10 years or so, and it is undoubtedly true that relations have been formed and cemented which will lead to a better understanding and increasingly beneficial mutual relations in the near future.

## GEOGRAPHY, TOPOGRAPHY, AND CLIMATE.

### GEOGRAPHIC POSITION—CONFINES OF REGION.

The West Coast occupies, in the Republic of Mexico, a geographic position similar to that of the Pacific Coast States in the United States. Washington, Oregon, and California may be compared geographically with the Mexican States of Sonora, Sinaloa, and Nayarit (formerly the Federal Territory of Tepic).

There is also a remarkable similarity, in position and effect, between the Sierra Madre Range of mountains in Mexico and the Rocky Mountain Range in the United States. Both cut off the Pacific States from the interior central districts by their natural barriers, causing the respective Pacific coast territories to be well defined as distinctive regions.

The part of Mexico commonly known as the West Coast extends from the international boundary, where it divides the American State of Arizona from the Mexican State of Sonora, south for a distance of some 1,200 miles in a southeasterly direction. The average width, from the high line of the Sierra Madre Range on the east (which is the dividing line) to the Pacific Ocean on the west, is about 130 miles. The international boundary begins at a point on the Colorado River about 16 miles south of Yuma, Ariz., whence it runs in a straight line directly southeast to Nogales between parallels 31 and 33 north, and from Nogales due east to the point where the dividing line between New Mexico and Arizona almost joins the boundary of the Mexican State of Chihuahua, which point may also be taken as the approximate northern termination of the Sierra Madre Range. From this latter point the eastern boundary of the West Coast territory proper follows the summit line of the Sierra Madre Range, which is the largest and most important mountain range of Mexico—the western watershed being considered as West Coast territory, even though a portion of the area is found within the boundaries of the States of Chihuahua and Durango.

The southern confines of the West Coast may be said to be determined by the southern boundary line of the State of Nayarit, with part of the boundary of the State of Jalisco completing the eastern line of the territory under discussion; although commercially the West Coast territory may also be said to extend into Jalisco and Colima, with the city of Guadalajara as the southern trade center. However, for the purposes of this survey, the territory of Guadalajara is regarded as a separate commercial unit, since it takes in two other important trade areas of Mexico besides that of its immediate surrounding territory. With the extension of the Southern Pacific Railway from Tepic to Guadalajara the two commercial districts will rapidly become better unified; for the purposes of trade-territory definition, American exporters would then regard the Guadalajara district as included in their "West Coast" sales territory, and it should be borne in mind, for future consideration, that the trade territory of Guadalajara is second only to that of the Capital district in importance. The Gulf of California and the Pacific Ocean form the western boundary of the West Coast district. The southern end of this territory is, approximately, parallel 21.

## ROUTES OF ACCESS AND TRAVEL INFLUENCES.

The summit of the watershed of the Sierra Madres being the dividing line between the West Coast territory and the rest of Mexico, routes of access are determined by the lines of least resistance and the factor of transportation facilities. The routes were greatly changed by the construction of the railway down the coast from Guaymas in 1908 and 1909 contemporaneously with the building of the unfinished Kansas City, Mexico & Orient Railway from the port of Topolobampo to Fuerte. Before the building of the coast line of railway by the Southern Pacific Co. the principal activity and interest on the part of foreigners in the West Coast of Mexico—with the exception of the commerce by water to and from San Francisco, Calif.—was in mining, and the movement was extended from the mining centers of Chihuahua to the west across the range, coming from Parral, Durango, etc. From the Pacific coast of the United States the easiest means of communication was from San Francisco by steamer to either Mazatlan or Guaymas, and exploration and development were of necessity carried on at long range and with few facilities for making them effective, except in the unusual cases of a few rich mine properties.

The construction of the coast line changed this. Passenger and freight trains now operate directly from the border at Nogales to Tepic, near the southern end of the territory of the West Coast, and penetration into the mountains is from west to east from the railway at given points. Through Pullmans are operated out of Los Angeles to Mazatlan now, and Los Angeles has become the leading West Coast trade city and the place of greatest contact for activities affecting the development of the West Coast districts, the trade being shared with San Francisco despite the long-established commercial relations of the latter city. San Francisco and Los Angeles are now close rivals for the trade of the Mexican West Coast, with the latter center making rapid strides, though San Francisco still retains its control of imports from Mexico and, through its brokers who know foreign markets, continues to handle a large volume of southern California export products.

As has been indicated, the continuation of the railway from its present terminus at Tepic to Guadalajara will bring about still further great changes in the West Coast trade and traffic. Travel now going around by way of the Mexican Central Railway from Guadalajara to reach the United States, or by water, via Manzanillo, to Los Angeles and San Francisco, will come directly by rail to Los Angeles first—an important trade consideration in itself. At the same time a wider market will be attracted by the very ease and rapidity of travel thus afforded to the Pacific coast of the United States, which will then have its trade territory in Mexico increased to two or three times its present extent. The exporters of the Pacific coast will then be able to compete with the Middle West and East (New York) in the commercial districts of which Guadalajara is the center, extending their activities still farther eastward into the interior of Mexico, where the population is more densely concentrated.

In this connection it should again be emphasized that the present economic problem of the West Coast is one of marketing its products

and that the present consuming capacity of this region, until such time as new products are developed, is necessarily limited to the needs of a too small population which has not as yet reached the stage of average production prevailing anywhere in the United States. However, it has been demonstrated in actual practice that firms of the Pacific coast (Los Angeles and San Francisco) can successfully enter this market and secure, by careful and industrious development of the sales territory, what amounts to a monopoly in their respective lines. With ocean transportation from both California ports, export houses are already entering the Guadalajara district, and this extension of their activities is of the utmost importance, as it is preparing and cementing the relations which will become infinitely more valuable after the completion of the railway from Tepic to Guadalajara.

Although the subject of transportation will be dealt with in more detail under that special heading later, it is thought necessary to point out at this point the present situation with respect to rail and water transportation and its effect on trade relations and selling territory.

The West Coast Line of the Southern Pacific Railway, now reaching as far south as Tepic, is still in effect a local line without trunk connections with the interior lines of Mexico, and it is therefore deprived of the "through tonnage haul." This condition, combined with the present high freight rates in the United States, make all-rail shipments in less than carload lots, say from San Francisco to Mazatlan or Tepic, prohibitive when compared with the prevailing water rates. Therefore firms in Los Angeles or San Francisco selling goods to a buyer south of Culiacan should be careful to compare freight costs and to follow the purchaser's instructions as to shipments by water to Mazatlan—to be sent from there either north or south along the railway to point of final destination. All the larger houses north and south of Mazatlan in Sinaloa and Nayarit have their arrangements made for forwarding from Mazatlan all shipments received by water from the Pacific coast of the United States.

In this connection there have been in the past too many cases where the shippers in San Francsico and Los Angeles, lacking definite and particular instructions from the buyer to ship by water, made shipment by rail, with the result that freight charges cost the buyer more than the goods were worth and a claim resulted against the seller in the United States, who should at least have investigated the matter of rates. It is a fact that the extra port charges for stevedoring, transfer-to-rail charges, etc., caused by shipments coming in to Mazatlan for transshipment into the interior by rail, just about balance the customs brokerage and other extra charges involved at the border port of Nogales. The difference in favor of water shipment lies in the lower steamer rates. There is no element of time involved—except possibly on certain classes of parcel-post shipments—in view of the present excellent and competitive steamer service to the west-coast ports of Mexico from the Pacific coast ports of the United States.

## AREA.

According to the hydrographic report on the west coast of Mexico made by Frank H. Olmstead in 1909, the "impetus zone" of the Southern Pacific Railway of Mexico, then under construction south-

ward from Guaymas, included 154,000 square miles of territory, reaching from the summit of the Sierra Madre Range at the American border at the junction point of the States of Sonora and Chihuahua, and extending down to the southern border of the State of Jalisco on the east, and to the Pacific Ocean and the Gulf of Lower California on the west, as far south as the State of Colima—including the Mexican States of Sonora, Sinaloa, Nayarit, and a part of Jalisco. The total surface area of the Mexican Republic being stated as 767,325 square miles, the area of the West Coast proper may be said to represent, for the purpose of a rapid comparison, about one-fifth of Mexico's total area.

## DIVISIONS OF COMMERCIAL TERRITORY.

If one considered the term "West Coast" when viewing Mexico as a whole, all of the Pacific littoral would ordinarily be included, taking in the States of Sonora, Sinaloa, Nayarit, Jalisco, Colima, Guerrero, Michoacan, Oaxaca, and Chiapas, although parts of the areas of the three last named properly belong, commercially speaking, to the central part of the country, being more accessible (on account of topographical factors) to Mexico City and Guadalajara. The total coast line on the Pacific is 3,883 miles, as compared with less than 2,500 miles on the Pacific coast of the United States. Including all the above-mentioned States in the term "West Coast," the total population would be about 5,165,500 (including Lower California) and the total area approximately one-half that of the Republic—the population being greater than that of Australia (5,030,479, census of 1918) or of the Pacific coast of the United States (California, 2,377,549; Washington, 1,141,990; Oregon, 672,765; total, 4,192,304). However, for the purpose of this report, and on account of the limitations of topography and the lack of transportation facilities, the West Coast territory proper is limited to the States of Sonora, Sinaloa, and Nayarit, together with a small mountainous portion of western Durango and Jalisco, reached from Mazatlan and Tepic.

Until railway connections are established between Tepic and Guadalajara, the latter city and its great commercial territory will have to be considered as a separate commercial unit which includes the western part of Michoacan and all of Jalisco and Colima. The parts of Guerrero and Oaxaca which can be reached from the port of Acapulco are of very small commercial importance on account of the great mountain barrier along the coast and far inland; but there is no reason why American Pacific coast exporters and manufacturers can not compete with New York and with Europe for the business of Chiapas and the entire isthmus of Tehuantepec.

Another factor which limits the importance of the West Coast trade territory south of Nayarit for the exporters of the American Pacific coast is the fact that the greater proportion of the population of Michoacan, Guerrero, and Oaxaca is found in the eastern parts of those States and is therefore nearer and more easily accessible to Mexico City, the great trading, commercial, and financial center of the country. These territories have to be considered as separate sales areas for the time being, distribution being different, although the same sales force and traveling salesmen cover the West Coast district included in this survey, the Guadalajara region, then Acapulco and

Salina Cruz, continuing down the west coast of Central and South America.

Because of (1) the development in the past of railway lines from Mexico City to points in all directions from the capital (reaching Zacatecas, Guadalajara, Morelia (Michoacan), Oaxaca, etc.), (2) the fact that trade channels from the capital to New York and Europe have been through Vera Cruz, and (3) the existence of the long and firmly established wholesale houses in the capital, exporters of the Pacific coast of the United States have not, as yet, secured what may be considered their proper share of the business of the great Guadalajara region; and, given cheap and rapid water service to the Pacific port of Manzanillo (shipment by water is preferred by the importers even to Mazatlan) from the Pacific coast ports of the United States, with through bills of lading issued right in San Francisco or Los Angeles for interior points in Mexico, via Manzanillo, there is no reason why their greatest export business opportunity should not lie in the development by increased effort of their sales in this region, the second in commercial importance in Mexico. Jalisco has a population of 1,202,802; Michoacan, 991,649; Colima, 77,704—a total of 2,272,155 people, those of Jalisco possessing the highest purchasing power per capita of any people in Mexico. Operations in the Guadalajara district would quite naturally lead, in time, to an extension of effort in Zacatecas, Guanajuato, and San Luis Potosi.

The State of Sonora has an area of approximately 76,900 square miles, being second only to Chihuahua, in surface area, among the Mexican States. Sinaloa has an area of about 27,000 square miles. The new State of Nayarit, formerly the Federal Territory of Tepic, has a total area of 10,954 square miles. The surface areas given do not include the various islands and island groups which lie off the coasts of the three States mentioned. The rest of the area included in the West Coast territory proper—namely, 154,000 square miles—includes the parts of Durango, Jalisco, etc., reached commercially from Mazatlan and Tepic, or from rail points to the north.

Mexico itself is some 1,900 miles long by an average width of 750 miles, while the territory or region of the West Coast is 1,200 miles long by some 130 miles in average width.

## TOPOGRAPHY.

### SURFACE AND RELIEF.

The outstanding physical features of the West Coast territory of Mexico are the high dividing range of the Sierra Madre Mountains, which forms the barrier separating the West Coast from the rest of Mexico, and the narrow coastal plain extending from north to south and of varying widths, crossed by numerous rivers which cut it into valleys running east and west. The general relief has been likened to that of the Pacific Coast States of the United States, the Sierra Madre Range corresponding to the Rocky Mountains of the western part of the United States so far as the main division from the rest of the respective countries is concerned, but with considerable differences in the minor formations. Throughout the West Coast of Mexico, with the exception of the extreme southern part of the State of Nayarit, such ranges as are found on the immediate Pacific coast in the United States are either absent or consist merely of groups

of hills here and there. The river valleys all run straight from the sources in the mountains to the ocean, from east to west, in contrast to the important interior longitudinal valleys that one finds throughout the Pacific coast of the United States.

In several places along the West Coast, the foothills of the main mountain range come down to the sea and cut down the width of the plain, to the north and south of these formations. This is most noticeable at and just to the south of Guaymas, just to the south of Topolobampo, at Mazatlan, and south of the port of San Blas in Nayarit. Heavy spurs of the main range, extending toward the coast between the various river valleys and the main body of the mountains, cut off the coastal plain entirely at Cape Corrientes north of Manzanillo, and this plain does not again become important until the great delta of the Rio Balsas is reached, far to the south in Guerrero, lying north of the port of Acapulco, and excluded from the territory covered by this survey. The relief map of the West Coast of Mexico shows the widest areas of level land in Sonora, extending inland up the Yaqui and Fuerte River Valleys, then growing gradually narrower until they are almost nil at Mazatlan, and then again gradually widening out to a maximum width in the Santiago River Valley in Nayarit.

The Sierra Madre Occidental—to distinguish it from the Sierra Madre Oriental of the eastern part of Mexico—is the most formidable mountain mass in Mexico, and consists of a fairly continuous chain of narrow and steep, high ridges. Its width increases from about 100 miles at its northern extremity near the American border in Sonora and Chihuahua to about 300 miles farther south, where it becomes lost in the volcanic belt of the southern and central part of the country. Its average elevation is about 5,000 feet above sea level on the north, increasing to about 10,500 feet at about latitude 26° north, opposite the mouth of the Fuerte River. In several places there are peaks and mountain masses of notable elevation, snow clad all the year round, such as La Cumbre, 10,426 feet above sea level, in Durango near the Sinaloa line; "El Pinal," 11,316 feet above sea level, in western Jalisco; and farther south the famous volcano of Colima, 14,104 feet high. From the central plateau the ascent to this mountainous region is fairly easy, but from the coastal plains the ascent is steep and difficult except in the north in Sonora where the range is lower and where desert conditions prevail except in the higher reaches of the range itself in the southern part of that State. The few rivers—such as the Choix (an affluent of the Rio Fuerte) and the Rio Verde, in Chihuahua—that breach this range from east to west afford no practical route, as their courses in the mountains are deeply cut canyons, hindering, rather than facilitating, travel.

Prior to the construction of the railway down the coast from Guaymas, and on account of the influence of the mining development by Americans and British on the eastern side of the Sierra Madre Range, most of the travel was by mining men from Chihuahua and Parral seeking prospects and mines by crossing the range to the west and coming out at the coast towns, such as San Blas, Culiacan, Mazatlan, etc. There are, however, certain mineralized regions, such as that of the San Dimas district inland from Mazatlan, that have always been more accessible from the coast.

The Sierra Madres have always acted as a formidable hindrance to the east-and-west trade of Mexico and have isolated the region of the West Coast from the interior of the country, causing the traffic and contact of the former district to be chiefly with the United States. Nowhere in Mexico have the people had more intimate contact with those of the United States, and the importance of the close geographic relation to our Pacific Coast States has already been pointed out.

On account of the broken nature of the mountains, the consequent difficulty of transportation, and the development of mineral resources since Spanish colonial times, mining has been the one development of the highlands contiguous to the West Coast region.

### PACIFIC COASTAL PLAIN.

The Pacific coastal plain of Mexico is varied and irregular and can be divided into three main regions. The first division—that of the territory covered by this report—reaches from the American border at Yuma down to Cape Corrientes, just north of parallel 20° north. The second division lies north of the port of Acapulco and takes in the delta valley of the Rio Balsas. The third division is called the Costa Grande and reaches from Acapulco south to the isthmus of Tehuantepec, that part north of Acapulco being called the "Costa Chica." The total length of the first division is, roughly, 1,200 miles, and its river valleys constitute the real wealth of the West Coast and afford the greatest opportunity for development.

Fifteen rivers cut the plain into a series of large and small valleys, between which lie bench land areas, with here and there spurs of the mountain foothills reaching down to the sea—some of them terminating in prominent points. The largest area of level land extending inland is found in Sonora in the desert region north of Guaymas, this region gradually ascending to the flat interior plateau of the northern central part of the State, a condition that continues to the American border near Nogales. The coast line runs northwest-southeast in general direction, and the rivers come down from the mountains at right angles, there being slight variation to this general rule. The flat interior plateau of Sonora is divided into two parts. The first extends along the Arizona-Sonora boundary line west from Nogales, with a smaller division up toward the extreme western part of the State near the Colorado River; the elevation being between 2,000 and 3,500 feet above sea level. A large circular basin occurs west of Magdalena where the San Ignacio and Altar Rivers have formed an inland "delta." Neither of these rivers reaches the sea (except in the rainy season of certain years of extraordinary rainfall); they disappear in the desert toward the coast north of Guaymas. Between Magdalena and Hermosillo there is another interior tableland, south of which the Sonora River (Hermosillo) forms another interior sink, or basin, which has two divisions—one running with the river westward toward the gulf, and the other south toward (and reaching) Guaymas. The next level area is that of the great delta of the Yaqui River, a fan-shaped level valley starting at the point on the railway where the Yaqui emerges from the last of the mountain spurs. Then follow the other rivers to the south, with the intervening mesas and hills, which reach far back inland to the higher mountains.

GENERAL DESCRIPTION OF COAST LINE.

The coast for a distance of 90 to 100 miles south of the mouth of the Colorado River is low and sandy, relatively even, with few indentations, and with deep water close inshore. The only anchorage is that of George's Bay, where a small 10-mile railway reaches the "Las Pintas" mine.

From Guaymas to the head of the Gulf of California is a distance of about 320 miles, and the greater part of the Sonora coast line is sandy and little indented. The sand dunes, in places, extend inland for as much as 15 or even 20 miles. A little north of Guaymas there are two coves affording anchorage for small boats engaged in fishing. Tiburon Island has an area of about 400 square miles and a maximum elevation above sea level of 3,990 feet. It is inhabited by a few Indians of the Seri Tribe. Desert conditions prevail all along the coast and inland north of Guaymas. South of this port the coast becomes more irregular, having more or less prominent points between the river valleys at the coast, and between these the shore is fringed with small and narrow islands lying close inshore and forming large lagoons of brackish water. (For a more detailed description of the coast south of Guaymas, see "Hydrographic description of West Coast," beginning on p. 97.)

In the northern Sonora part of the West Coast the plain is about 200 miles in width, of which some 60 or 70 miles consist of low, level coast lands having an average elevation of not more than 200 feet above sea level, the rest being a region of foothills and level plateau of about 2,000 feet average elevation, with here and there peaks of 5,000 feet or more. South of Guaymas and the Yaqui Valley, which is a formation in itself, the coastal plain proper gradually narrows after each succeeding river delta, until at Mazatlan it disappears entirely, to open up again to the south with variations until the Rio Santiago is reached, after which it again narrows to nothing at Cape Corrientes, with only two intervening valleys of any importance. The "width" of the coastal plain is dependent upon the length of the various river valleys, the average being some 30 miles from the sea, although the Yaqui, Fuerte, and Santiago River Valleys extend much farther inland.

Guaymas Bay is an almost landlocked harbor, said to be formed by the crater of an extinct volcano and certainly having that appearance. The surrounding hills have a height of 1,500 feet, and outside of the inner bay there is a shallow bay which extends inland for 5 miles to the rail point of Empalme, where are located the shops of the Southern Pacific Railroad of Mexico. Vessels of 18 to 20 feet draft can lie in the outer harbor, which is protected on all sides except from the south and southwest, but only vessels of 10 to 12 feet draft can enter the inner harbor in front of the town. There are proposals to make Empalme the port for large ocean tonnage, but the building of the railway to the south along the coast has caused Guaymas to diminish in importance, and it is doubtful whether such plans will be carried out. (See also "The port of Guaymas.")

The next port of any importance is that of Topolobampo, the bay being a long inlet from the sea and having a dangerous bar at its entrance, which is only practical for very small steamers in the coastwise trade. Between here and Guaymas the coast is low and sandy,

FIG. 1.—BANK OF SONORA, GUAYMAS.

FIG. 2.—MUNICIPAL PALACE, GUAYMAS.

FIG. 3.—PUBLIC MARKET, GUAYMAS.

with many lagoons fringing the river delta formations. There are three ports, the first being Medano Blanco, at the mouth of the Yaqui River in a large shallow bay and of small commercial importance. Then there is the new port of Yavaros, situated at the mouth of the Mayo River, south of the Yaqui, and formerly called Santa Barbara. Yavaros is the objective of the new Mayo River Valley Railway, now under construction from the rail point of Navojoa, and will become, upon the completion of this new railway being built by the Mexican Government, the principal "garbanzo" shipping point of the West Coast. Deep water can be secured by extending the railway to a pier projected on the end of the island lying in the large shallow bay. The next port is that of Agiabampo, a large shallow bay situated just north of the mouth of the Fuerte River. It is also a port of call for the small coasting schooners and launches and handles some beef cattle from the valley for Guaymas and Lower California mining camps like Santa Rosalia.

Just south of the mouth of the Fuerte River is the port of Topolobampo, the largest bay on the West Coast and a very good protected harbor when once vessels have negotiated the shallow and dangerous bar lying offshore. Only 2¼ fathoms of water are reported on the bar at mean low tides. The inner anchorage lies about 9 miles inland up a narrow and twisting channel of deep water, which is easily navigable. The wharf has plenty of deep water alongside and is the terminus of the Kansas City, Mexico & Orient Railway, which was built inland as far as the town of Fuerte at the head of the valley of the Fuerte River, whence the line is surveyed to cross the range to connect with the extension from the American border at Presidio del Norte in Texas. (See p. 50.)

Perihuete, or Playa Colorado, is another small bay formed by the offshore alluvial islands, just north of the mouth of the Mocorito River. It is like Agiabampo and Medano Blanco, and is of small importance. Vessels of any considerable size have to anchor 4 miles offshore, but are protected from the sweep of the sea.

The next port is that of Altata, similar to the other shallow ports mentioned above. It was of some importance as the port for Culiacan and the Culiacan River Valley up to the time that a great storm partially closed the entrance to the bay, which is formed by a series of long, narrow islands lying about 4 miles offshore. The old entrance was on the north, and the new entrance to the south is opposite the mouth of the Culiacan River over Tonina Bar, which is reported to have 4½ fathoms of water, but with only 2 fathoms at the anchorage at the town which is the terminus of the Occidental Railway, an old narrow-gauge line built by British capital many years ago for the traffic of Culiacan.

There is a small harbor at the mouth of the San Lorenzo River that has been used by the El Dorado sugar properties of Redo y Cía., but only when the railway down the coast was out of service during the revolutions in Mexico.

Mazatlan is not a protected natural harbor, but is formed by rocky projections of the foothills which here come down to the seacoast. There is a large but too shallow inland bay only used by small craft.

From Mazatlan south, the coast is much indented by large, shallow lagoons, especially in the neighborhood of the various river mouths.

San Blas is an old harbor used by the colonial Spaniards in the days of the son of Hernan Cortes, but its natural facilities are very poor and there are no improvements. Farther south are Banderas Bay and the small port of Las Penas. Manzanillo is a good port on Manzanillo Bay, where the anchorage is protected by a breakwater, and further improvements are projected. This is the rail point for the interior of Mexico from the west coast via Guadalajara. Another small bay and port is that of Chamela, about 70 miles north of Manzanillo, once the chosen terminus of a proposed railway from Gauadalajara to the coast via Colima.

The Tres Marias are a group of islands lying just south of parallel 22° and opposite the mouth of the Santiago River in the State of Nayarit. The distance from the nearest port, San Blas, is from 60 to 100 miles offshore. The islands are lofty and rugged, and only on Maria Madre, the largest, is there an anchorage. They lack sufficient water supply, but have been used in times past as a penal colony by the Mexican Government. Some guano is produced at times. Another group of islands, called the Tres Marietas, lie off Mita Point, the northern headland of Banderas Bay. Guano is shipped from them at times.

### RIVERS.

As has been said, 15 rivers cut the West Coast plains into level delta valleys. These rivers, from north to south, are mentioned below. In Sonora there are, first, the Altar and the San Ignacio, the former rising near Nogales, Ariz., and the latter east of Magdalena—the two joining near the town of Altar, from which point the river, now called the Asuncion, flows directly west toward the Gulf, which its waters do not reach, being absorbed in the desert. Then comes the Sonora River, which forms the Hermosillo Valley at the town of that name in central Sonora. This river rises near the American line north of the old town of Arispe (once the capital of the royal provinces of Sonora and Sinaloa in Spanish colonial times), the course being south and then west at Hermosillo. It does not reach the ocean except in years of exceptionally heavy rainfall.

Next, in Sonora, comes the great Yaqui River, heading far up in the Sierra Madres and, next to the Fuerte and the Santiago, the largest river on the West Coast of Mexico. South of the Yaqui Valley the extreme desert conditions begin to give way to increasing rainfall toward the south along the coast, and the Mayo River Valley shows the change in vegetation. Then follows the great Fuerte River, which has its source farthest up in the range, above the 40-inch rainfall line; it carries a greater volume of water, later in the dry season, than any other of the West Coast rivers.

Next come the less important valleys of the Sinaloa and Mocorito Rivers, between the Fuerte River and the Culiacan River Valley. Between Culiacan and Mazatlan there are four other rivers—the San Lorenzo, the Elota, the Piaxtla, and the Quelite. South of Mazatlan, and before the great Santiago (the largest of them all) is reached, there are the Mazatlan, the Rosario, the Acaponeta, the San Pedro, and the Guasameta (affluent of the Santiago). South of the Santiago are the lesser rivers, the Compostela and the Ameca, the latter the only important stream south of the Santiago until the mouth of the great Rio Balsas is reached, far to the south of Manzanillo and outside of the West Coast region under consideration.

(For detailed description of the rivers of the West Coast of Mexico, see "Hydrographic description," under "Agriculture," beginning on p. 97 of this report.)

### LAKES.

With the exception of the large lagoons, or "esteros," along the coast, there are no lakes of importance in all the West Coast region; only in Nayarit are lakes found at all inland, and the two existing are small and unimportant.

The rivers of the West Coast form the potential wealth of the region by reason of their alluvial formations, and it is only in these river valleys and their deltas that good agricultural land is found anywhere on the West Coast in any considerable extent. In the chapter on "Agriculture" will be found the detailed description of the formation, extent, and hydrography of each river valley.

## CLIMATE.

### CLIMATIC ZONES.

In Mexico, as in all other Latin American countries within the Tropic Zone, climatic conditions are a matter of elevation above sea level, and this rule applies to the West Coast. There are three divisions, or zones. The first is that of the coast and the territory extending inland to an elevation of some 3,000 feet above sea level, called the "tierra caliente"; this includes, on the West Coast, the seaports and all the towns along the railway, south of Guaymas, with the exception of Tepic in Nayarit, which has a sufficient elevation to make its climate much cooler than the immediate coast.

The next division is that of the "tierra templada," from 3,000 to 6,500 feet above sea level. Unlike the rest of Mexico, there are no towns of importance at these elevations on the West Coast, the country being too broken and difficult of access from the coast. All agriculture of any importance flourishes in the hot valleys of the rivers near the coast.

The third division is that of the high sierras, from 6,500 feet to the snow line, taking in the most rugged and inaccessible part of the mountain range of the Sierras.

It has been said that topographically and climatically the West Coast of Mexico very much resembles the Pacific coast region of the United States. Climatically, however, conditions are reversed in direction, and the modification of climatic conditions farther to the south should also be taken into consideration. The heaviest rainfall on the Pacific coast of the United States is found in the northern part, this precipitation diminishing gradually toward the south until desert conditions are encountered in the extreme southern part of California where, in the Imperial Valley, the average annual rainfall is only 2.4 inches. Inversely, the lowest rainfall of the West Coast of Mexico is in the region just south of the American border, across from Arizona, where, in northwestern Sonora, extreme desert conditions obtain. The rainfall increases slightly toward the south—Guaymas, 320 miles south of Arizona, having an annual rainfall of about 5 inches. Also, inland, the rainfall increases toward the mountains until an annual average of 15 inches is reached, but this does not provide to the rivers north of Guaymas sufficient water for the extensive irrigation development needed in connection with the available land in the river valleys.

South of the Yaqui Valley the rainfall increases gradually. The Culiacan Valley has an annual precipitation of about 20 inches (but not constant each year); Mazatlan gets nearly 30 inches of rainfall and Tepic has nearly 40 inches. In certain places in the southern part of the State of Nayarit nearly 60 inches of rainfall have been registered in some years.

With the exception of the mining activities of the more mountainous part of the West Coast territory, all the development on the coast has been in the hot river valleys where tropical, or at least semitropical, conditions obtain, the humidity and moisture increasing with the increasing rainfall toward the south. Only in the "tierra fria" of the high mountains does the temperature fall below freezing point, although the entire coast is subject to damaging frosts during the winter months, except in the extreme southern end of the West Coast proper, south of the port of Mazatlan.

### SEASONS.

There are only two seasons, the dry and the rainy, the former lasting from October through the winter, spring, and summer months to the end of June, when the rainy season usually begins. However, the rainy season may vary as much as a month in some years. The dry season is warm, very hot, in fact, during March, April, May, and June until the rains begin. During December, January, and February there is a great variation between the day and night temperatures, sudden drops of from 15° to 20° being common. This is one of the peculiarities of the West Coast climate that is not well understood by persons interested in prospective agricultural development there. The region of the coast north of Mazatlan is called "frostless," but this is not true, as frosts occur which occasionally damage the winter tomato and vegetable plantings. No absolutely frostless region is found until one reaches the valley of the Rio Santiago, in Nayarit, and the region south of there along the coast, where bananas do very well. However, on account of the sudden and heavy drop in temperatures even in this region of heavier rainfall and no frost, the growth of such tropical products as bananas is retarded to a very appreciable extent. For example, in Costa Rica and Colombia bananas produce every seven months (on an average) from the time of planting, while in Nayarit, south of San Blas, 11 months is the average, the delay in maturity of the fruit occurring from December to March each year on account of the low temperatures at night.

On the coast the rainy season is very hot and humid and generally unhealthful to Americans and Europeans. Malaria is prevalent to a considerable degree, along with other minor tropical diseases to which foreigners are more subject than the natives, but which also affect the natives in a latent manner.

The high desert plateaus of northern and central Sonora are subject to the same winter conditions as the country along the American border in the neighborhood of Nogales. High and cold winds, called "northers," which sweep down from the north and northeast, bring intense cold spells lasting for about one week at a time. Farther south there is little effect from these cold winds and the sea air currents are felt.

In eight-year cycles heavy storms, called "chubazcos," occur along the coast and in the Gulf of Lower California, at times doing considerable damage to shipping and seaport cities and towns. The worst of these sudden and heavy storms occur during the season of the fall equinox at the end of the rainy season in September or October. Storms of less violence also can be expected in the spring equinoctial season—February or March. These atmospheric disturbances come every year during the periods mentioned, but only once in every eight years is their intensity sufficient to cause heavy loss. These storms carry far inland and have even caused serious damage to the railway line between Guaymas and Hermosillo in times past. The general meteorological condition would appear to be very much the same for the entire west coast of Mexico, Central and South America.

Some years the spring equinoctial storms bring too heavy rains, which cause real floods in the river valleys and damage to crops and property. As a usual thing, light but steady rains occur throughout the West Coast during the latter part of February or early in March, according to the equinoctial season. These light spring rains usually last for two weeks and are depended upon throughout the southern half of the West Coast to mature winter crops of corn and beans planted only in bottom lands along the rivers. However, even in Nayarit in the Santiago Valley, these winter rains are very variable in quantity and can not always be depended upon to be sufficient to make a good crop.

### TEMPERATURES.

During the summer months, days of 100° F. and over are not uncommon on the West Coast from Hermosillo south. In the extreme northwestern part of Sonora the annual average mean low temperature is 54° F., and the maximum mean temperature around 90.5° F. In the region of Mazatlan the mean low temperature is around 67° F. with sudden drops to just above freezing, or at times a little below that mark. The maximum mean average during the summer months is 93.3° F. There are many variations in these figures between the points mentioned. On account of the importance of climatic conditions affecting agriculture on the West Coast, more detailed data of rainfall, temperatures, etc., will be given later under "Agriculture."

As of general information to the traveler, it may be said that the summer climate of the West Coast is hot, humid, and unhealthful, and that the winter climate is almost ideal, surpassing that of southern California in equality of temperature and uniformity of days.

### EFFECT OF CLIMATE ON COMMERCIAL ACTIVITIES.

The effect of these climatic conditions on trade activities should be thoroughly understood and taken into account by the exporter interested in the trade of the West Coast of Mexico, both import and export. During the rainy season (June to October) roads and trails are almost impassable even for the pack mule and the two-wheeled oxcart of the country, and even the railway is hampered by a series of washouts, landslides, etc. At the beginning of the rainy season the cattle are moved from the fields in the valleys to the foothills and higher mesas inland. The population being instinctively agricultural, except in the few and scattered mining towns of the moun-

tains where crops can not be planted, the men leave other work and prepare for the corn-planting season in the foothills and in the river valleys of the coastal plain. The transport of mine products and supplies to and from the railway along the coast stops, as does also the production of hardwoods and other minor products of export. Business in the stores in the towns and cities becomes practically suspended after the brisk buying season just before the rainy season is to start (which is always the busiest commercial time of the year), and nearly all activity centers around planting. Trade does not again become at all active until after the harvest in November and December. This is true of the regions yielding all the various products—wheat in Sonora, the "garbanzo" of the Mayo and Sinaloa River Valleys, and the corn and beans of the rest of the coast and foothill country.

Even the sugar people employ a minimum of labor during the rainy season, which is also the growing season for the sugar cane, the cutting and grinding seasons beginning in December. In the past few years winter tomato planting has developed into a great industry throughout the West Coast from the Fuerte Valley south to the Santiago Valley, and even this new industry takes its maximum supply of labor toward the end of the corn-harvesting season—a condition that is very fortunate for the growers of tomatoes and winter vegetables, since otherwise their efforts would be seriously curtailed by the lack of sufficient labor when they most need it.

Commercial activity increases rapidly at the time of the disposal of the wheat, corn, and bean harvest in December; and importers buy accordingly, placing their heaviest orders toward the last of the year in preparation for this demand, and again in May for the preplanting outfitting demand. Local accounts are usually settled from one planting season to another at the time of the crop delivery after the harvest. Delivery takes place all the way from the first of December to March. Tomato shipments to the American market centers begin in February and last until the Florida and California crops start to move early in April. This influx of money is now helping the merchants to extend the buying season after March of each year.

The mining industry buys heavily of all sorts of supplies just before the rainy season, because supplies, machinery, etc., can not be moved into the hills and mountains after the heavy rains begin, and there is also a scarcity of labor, as all the men who are not professional miners take to the hills and valleys for the corn-planting season.

Many of the West Coast merchants are spending most of the slow summer months in the United States with their families, using this time for their season's buying trips to the commercial supply centers. On account of the proximity and climatic conditions, California is getting "first call" as regards most of these visitors, and this condition has helped California manufacturers and exporters to increase their trade relations with the West Coast of Mexico.

## POPULATION AND LIVING CONDITIONS.

### FACTORS AFFECTING DISTRIBUTION OF PEOPLE.

The West Coast zone of Mexico comprises about one-fifth of the total surface area of the country, or approximately 154,000 square miles, including the States of Sonora, Sinaloa, and Nayarit, and portions of the States of Durango and Jalisco that lie on the western watershed of the Sierra Madre Mountain Range and that are more easily accessible from the West Coast trade centers.

According to the census of 1921, the three States first named had a total population of approximately 760,000, representing about one-twentieth of Mexico's total number of inhabitants. The mountainous areas along the extreme eastern boundary of the development zone of the West Coast (in Durango and Jalisco) are very sparsely populated, there being, at present, only a very few isolated mining camps, so that the grand total can not be greatly increased, and the proportions mentioned above for comparative purposes are not materially altered.

It is also a fact that the rather high average birth rate of the country has been counteracted by the heavy emigration from Mexico to the United States during the past 11 years of disturbed conditions in the former country. Southern California alone, according to the figures compiled by the Mexican consulate at Los Angeles, has a population of nearly 200,000 Mexicans, and Mexican workmen are seen all along the transcontinental railway lines as far east as Kansas City and even Chicago. The largest percentage of these men comes from the West Coast States.

In the year 1876, Mexico's total population was estimated at 9,380,439; by the year 1910, the inhabitants numbered, roughly, 15,000,000, giving a total of 19.55 persons per square mile. Imports into the country during the 10-year period ending in 1910 increased from $21,490,604 (United States currency) to $146,376,587. This great increase in population and enormous increase in imports into the country was brought about and made effective by the 30 years of peace under the Diaz régime; it was more apparent in the more densely populated central part of the country than on the West Coast, which was isolated by its mountain barrier, effectively shutting it off from easy contact with the rest of the country. The Southern Pacific Railway had not been built down the West Coast; and new blood and the stimulus of new contact and education were, for the most part, lacking. In many of the communities here 10 generations had intermarried, with unfortunate results, and then came the series of revolutions to thwart development just at the time when the influence of the railway was beginning to make itself felt in the way of general economic and social improvement.

The West Coast has always lacked a sufficient population, and it is to-day fully realized by the people themselves that immigration is necessary if the rich alluvial valleys of the coast are to be opened and developed as they should be. In Mexico, as elsewhere, the

combination of level lands with adequate rainfall for crops tends to attract the largest population, and the bulk of the population of Mexico is essentially rural; but, like the east coast of the country, the West Coast is hot and fairly tropical, and the bulk of the population of the country is found in the regions of the south-central plateaus where the high altitude, adequate rainfall, and level formation furnish all the elements of easy transportation, rainfall, and good climate.

The native Indians of Mexico, in their various tribes and nations, were distributed along the above lines, and the invading Spaniards followed the same natural tendency, establishing their cities and towns on the same sites as those of the Aztecs and other native tribes in the country. The West Coast had no large Indian population at the time of the conquest of Mexico, and the centers of largest Indian habitation were determined by the river valleys, as, for example, Hermosillo in Sonora, Culiacan in Sinaloa, etc. The native of the highlands of the interior will not leave the cool climate for the hot lands of the coast, even if rich land with irrigation is provided for him, and, therefore, an adequate population for the West Coast is a matter of immigration and settlement.

The development of the dry, hot lands of the Imperial Valley in southern California, and also the arid and hot desert lands of Arizona, given water for irrigation, is an example of what the white man can do in the heat of the Tropics when attracted by cheap land with water, and an example has been set for the ultimate development of the West Coast by American settlement, as such settlement is impracticable from any other source.

As has been said, the present centers of population of the West Coast are determined by the river valleys, with the exception of the dry and arid northern part of the State of Sonora, where the existence of large and rich mining camps, such as Cananea, Nacozari, etc., attract most of the people in that region.

## POPULATION BY STATES AND CITIES.

In the following tables the population of the three States of Sonora, Sinaloa, and Nayarit are given, with comparative figures of the census of 1910 and that of 1921, together with the population of the various political subdivisions of the States. The Mexican census returns do not give the exact population of each city or town, but that of the "municipio," or district, which corresponds to the county in the United States

SUMMARY BY STATES.

| States. | Total population. | | Area. | Population per square mile. | |
|---|---|---|---|---|---|
| | 1910 | 1921 | | 1910 | 1921 |
| | | | *Sq. miles.* | | |
| Sonora | 265,383 | 267,474 | 76,922 | 3.5 | 3.5 |
| Sinaloa | 323,642 | 343,247 | 33,681 | 9.6 | 10.2 |
| Nayarit | 171,173 | 147,048 | 11,279 | 15.2 | 13.0 |

POPULATION BY DISTRICTS.

| Districts. | Population. | Districts. | Population. | Districts. | Population. |
|---|---|---|---|---|---|
| SONORA.[1] | | SINALOA.[2] | | NAYARIT.[3] | |
| Agua Prieta | 5,126 | Mazatlan (seaport and railway) | 25,231 | Tepic (capital; railway) | 16,800 |
| Alamos | 18,751 | Culiacan (railway) | 13,500 | Acaponeta (railway) | 5,000 |
| Altar | 2,148 | Rosario (railway) | 6,100 | Jala | 3,400 |
| Arispe | 5,175 | Escuinapa (railway) | 4,400 | Tecuala | 2,200 |
| Bacum | 4,412 | Guadelupe de los Reyes (mining camp) | 2,700 | San Blas (port) | 2,000 |
| Cananea | 11,269 | Concordia (railway) | 2,500 | Ahuacatlan | 2,000 |
| Guaymas | 14,246 | Cosala | 2,100 | Jalisco | 2,000 |
| Hermosillo | 19,237 | Mocorito (railway) | 2,000 | Compostela | 2,700 |
| La Colorada | 3,158 | San Jose de Gracia (mining camp) | 2,000 | San Pedro Lagunillas | 1,900 |
| Magdalena | 6,155 | Sinaloa (railway) | 2,000 | Amatlan de Canas | 1,800 |
| Moctezuma | 3,074 | Navolato (railway) | 1,700 | Jomulco | 1,800 |
| Garcia | 4,943 | La Noria (railway) | 1,500 | Santa Maria del Oro (mining) | 1,500 |
| Navojoa | 18,849 | Panuco (mining camp) | 1,500 | Santiago Ixquintla | 7,600 |
| Nogales | 14,753 | Villa Union (railway) | 1,500 | Huajicori | (4) |
| Oputo | 5,758 | San Ignacio (mining camp) | 1,300 | Ixtlan del Rio | (4) |
| Nacozari | 3,137 | Los Mochis (railway) | 1,200 | La Yesca (mining) | (4) |
| Quiriego | 3,523 | Choix (mining town) | 1,100 | Rosa Morada (mining) | (4) |
| Sahuaripa | 4,171 | Topolobampo (seaport and railway) | 500 | Tuxpam | (4) |
| Horcasitas | 3,480 | Badiriguato | 4,500 | | |
| Santa Ana | 4,974 | | | | |

[1] On account of the closing of most of the large mining camps in Sonora during the last 10 years, towns like Cananea and Alamos dwindled in population to a great degree. Before the great Cananea mines were reopened in August, 1922, the town did not have more than 2,500 people, as compared with 18,000 in the district in 1910. A similar condition prevailed in Altar, La Colorada, Nacozari, Arispe, etc., all formerly mining centers. The fastest-growing population in the State is that of the Mayo Valley at Navojoa, the "garbanzo" center. The town has possibly 3,000 people, the figure given being that of the total population of the county or municipality. The population of the port of Guaymas has also greatly diminished and is now estimated at about 5,000.

[2] The port of Mazatlan has attracted an increasing population, while the mining towns in the interior of the State have suffered accordingly. The completion of the Canal "Rosales" at Culiacan should increase the population in the near future. Outside of Mazatlan the population is increasing by drawing from the mining regions and the towns of the immediate interior at such agricultural centers as San Blas, on the Fuerte River, at the crossing of the Kansas City, Mexico & Orient Ry. and the Southern Pacific.

[3] The official State map gives the total surface area as 28,371 square kilometers, or 10,954 square miles, and, including the areas of the Tres Marias and Tres Marietas Islands, 29,378 square kilometers, equaling the figures given in the table above. The decrease in the population in the State of Nayarit has been due to the disturbed conditions obtaining for the past 10 or 11 years, causing the curtailment of industries and a consequent emigration of the people to either Mazatlan or Guadalajara, and even to the cotton fields of Arizona and the Imperial Valley region.

[4] No figures available.

Complete returns from the Mexican national census of November, 1921, are still lacking, and it should be borne in mind that the 1921 figures are incomplete and the official statistics inaccurate, because of the difficulties of collecting the data and the general disinclination of many of the rural inhabitants to give the required information on account of their fear of obligatory military service, taxation, etc.

## POPULATION OF CONTIGUOUS COMMERCIAL TERRITORY.

The Mexican States to the south and east of the West Coast proper—that is, the States of Jalisco, Colima, and Michoacan—have a total population of 2,272,155, or three times that of the three West Coast States treated in the present report. Pacific coast firms of the United States can now reach this important commercial territory through the center, Guadalajara, via the port of Manzanillo, and efforts at trade extension in this direction have already proved successful, although Guadalajara still buys heavily from the large wholesaling importers located in Mexico City, and also directly from New York or Europe to some extent. Commercial success in this territory is a question of sales work along the same lines that have

brought results to the firms of Los Angeles in extending their trade down the West Coast during the past three years. The completion of the railway from Tepic to Guadalajara will greatly enhance the personal contact with the Pacific coast of the United States, but the cheaper water transportation via Manzanillo will carry the bulk of the shipments, just as it does now.

## RACIAL CHARACTER OF THE PEOPLE.

To-day less than 8 per cent of the population of the West Coast of Mexico can be said to be of pure Spanish blood, descended from the original Spanish settlers of colonial times. Even in the higher social class, which forms about 10 per cent of the total population, there is seen the admixture of Indian blood, and this proportion is rapidly increasing, being materially augmented through the effects of the social upheavals of the last 11 years by reason of the problems of economic necessity and social readjustment involved. There are relatively few people of pure Indian blood left anywhere on the West Coast, and the only tribes existing are those of the Yaquis in Sonora and the Mayos in the Mayo and Fuerte River Valleys. The great bulk of the population is composed of persons of predominating Indian blood, among whom there is a great variation in the proportion of Spanish blood. Since colonial times the racial fusion has been going on, the result being a half-blood whose social status has been that of the "peon" (lowest class), but who, in turn, has carried on the admixture of the Spanish white blood among the lower class. Again, numbers of these half-bloods attained high social recognition after rising to wealth or political prominence.

Taking the country as a whole, the proportions, prior to 1910, were generally estimated at 10 per cent for pure white Spanish blood, the highest class of society; 4 per cent for the "middle class" (so called), composed of the artisans and small trades people; with the remainder consisting of the "peon" or "Indian" class, who were the workers in the fields, mines, etc. To-day the once small "middle class" is rapidly increasing, for various reasons, and is now estimated at about 25 per cent, being composed of members of the formerly land-wealthy class who have had to seek employment other than that of the administration of their estates, and also of members of the former lower class in whose veins runs a greater percentage of white blood and who have risen to be artisans and small shopmen. This latter class has also been considerably augmented by the members of the new political régimes, as many government positions are now filled by former members of the "peon" class. Another factor in the increase of the "middle class" has been the effect of "peons'" emigration to the United States. There they have been brought in contact with modern conditions and have been shown how to work to greater advantage. Many Mexicans in the United States have learned trades and better methods for the application of their energy, with the result that, returning to their homes, they have been able to better their condition and that of their families.

Commercially, this increase in numbers of the "middle class" has been, and is, a good thing. These people now consume foodstuffs and use wearing apparel, household goods, etc., that they would not have been able to buy before the new order of things in Mexico,

and it is this class that will soon form the largest portion of the consuming public in the country.

The mixture of the races has brought about the evolution of a type, or race, commonly called "Mexican"—darker in complexion than the Spanish or southern Italian peoples, but not so dark as the native Indian, and showing the characteristics of both the Spanish and the native Indian races, in both mentality and physique.

## ECONOMIC AND SOCIAL ASPECTS.

The characteristics of the Mexican people vary, of course, in the different parts of the country, climatic and economic conditions changing the mode of life to some extent. There is, however, a general willingness to accept a low standard of living, combined with a poorly developed sense of responsibility and lack of interest in modern methods and appliances. The semitropical climate of the coast region causes malaria, hookworm (tropical anemia), dysentery, and other tropical diseases to be prevalent, and this condition tends further to lower the energy and stamina of the people, more especially those of the rural districts.

Of importance, in this connection, is also the unrestricted use of alcoholic drinks, such as the "mescal" of the country, a powerful intoxicant, and the general lack of education, 70 per cent of the people being classed as illiterate. Malnutrition and disease are common throughout the coast region under discussion, and this is also true of the greater part of the country in general. It is a common occurrence to have to feed a gang of new men, engaged for heavy labor, for a few days before they can stand hard work in the sun, and Americans engaged in tomato growing have found great difficulty in securing the proper cultivation and care of the plants, proper selection, etc., in picking and packing, on account of the universal unresponsiveness of the people engaged in this work.

There is no lack of good land on the West Coast; the real lack is that of people to go on the land and produce on a large scale. There is no agrarian problem in any of the three Pacific Coast States considered in this report.

Many of the younger men of the wealthy class (including many "mestizos") of the West Coast have been educated in the United States, and thousands of young Mexicans have been forced to seek a livelihood in this country during the various disturbances in Mexico during the past 11 years. This has done much to spread modern ideas and methods in Mexico, and the effect is being seen in the increasing use of better tools, agricultural implements and machinery, etc., on the West Coast. There is also an increasing number of engineers, architects, and members of the other professions.

The men of the upper class engage in the professions, politics, and trade; the middle class is composed of the teachers and of the masons, carpenters, and other artisans, while the lower, or "peon," class comprises the manual workers of the country and also the rural population. As has been pointed out, the greatest economic, social, and commercial factor is the rapidly increasing middle class, despite the demoralizing effect of the years of revolution and political upheaval.

The most important factors contributing to the advancement and development of the people of the West Coast have been (1) the construction of the Southern Pacific Railway south along the coast from

Guaymas and (2) the influx of American settlers in the river valleys, where modern agricultural colonies have been successfully established.

## EFFECT OF THE REVOLUTIONS.

Possibly on account of the relatively sparse population, the lack of large capital for development within the country, and the lack of initiative on the part of the upper, or landowning class, sufficient community lands remained to the people of the West Coast for the production of enough food for their maintenance, except in the mountain region where the broken nature of the country caused level plow land to be scarce, forcing the scant population to take to mining as the only means of livelihood. It is true that in the river valleys where large tracts of level land existed, most of this good land, subject to irrigation, was acquired by the original Spanish colonials—not by taking it from the Indians, who were few in numbers, but by means of grants from the Spanish Crown, subject to its development, the Indians being left sufficient lands for their needs around their "pueblos" (also called "ejidos"), in which they enjoyed community rights. From the Spanish colonial times there was built up a system of share planting on the large haciendas of the valleys, most of the peons preferring this method, or customary system, because they themselves lacked the individual initiative to organize and work their own lands on anything like a fair scale, and the large landowners furnished, during the crop season, seed, equipment, and, still more important, a ration of food and clothing, which the individual had failed to provide for himself. By this system only were the largest crops produced, as the native, left to himself, would plant only for his immediate family needs for the season. He also preferred the easier way of planting by the "rosa" method—that is, merely chopping down the trees and brush on a hillside, burning it off during the dry season, and then planting with a stick. By this method there was no plowing and few weeds to take care of by cultivation, as the fire killed the weed-seed germination in the top soil. It was the easiest way, and also the ancient system of planting. The bulk of the Indian, or more modern "mestizo," population is, as has been said, essentially agricultural in instinct, but lacking in vision and ambition to do anything on a large scale.

In the foothills and mountains there are many tiny villages where small crops are grown but not in sufficient quantity to support the entire population, small as it is, and numbers of the people are forced either to work in the mines or to come down to the coast for wages with which to obtain the things they need. It is also true that their small planting, when successful, only furnishes enough corn for bare necessity, and that they depend upon work in the mines or on the coast lands to obtain extra money for clothing, etc.

Prior to 1911 it was almost impossible to secure sufficient labor for field work on anything like a large scale, as American landowners found to their cost after the seed was in the ground, even when they offered to pay double wages. The sugar people had difficulty every year in securing sufficient labor.

The exception to this rule is the population of the dry region of northern and central Sonora, a region devoted to cattle raising and mining, the latter employing by far the greatest amount of labor.

By reason of the arid nature of this region, the people were forced to meet the demands of modern organization in the mines and became fair workers, for the most part.

Prior to 1911, foreign land investors, attracted by the mistaken theory of the advantages of cheap labor, found to their cost that the general inefficiency and seasonal lack of labor supply, combined with the inherent fundamental characteristics of the people themselves, made organization, development, and crop planting on an adequate and efficient scale impossible and a costly experiment in the end. It remained for one or two progressive Americans, who knew the country and the people, to demonstrate that the so-called cheap labor of the country was, in the end, more costly than the high-priced labor of the United States, worked in combination with modern methods and machinery, such as tractors, etc. What was not understood by the newcomers to the West Coast was the fact that the element of time was the essential factor, because of the regularity and shortness of the rainy, or crop-making, season during the summer from the end of June to the middle of September, and that the problem was one of dry plowing and seeding in a sufficient area before cultivating had to start, so as to insure an adequate return on the year's crop investment.

The effect of the various revolutions since 1911 has been to accentuate the lack of organization and method on the West Coast and make the people more vaguely independent, without giving them any practical basis of economic betterment. On the West Coast only a small element of the population even joined the various rebel organizations, if they can be called such, although the bulk of the "peon" population had some vague idea that the new governments were going to make them independent and rich without any effort on their part. The general effect has been almost completely disastrous economically for the entire West Coast. The cattle supply has been seriously depleted, mines have been shut down all over the country, and many thousands of people have been forced to abandon their homes to seek a living in the United States. In the potentially rich Culiacan Valley the entire population of the district was only saved from partial starvation after two years of crop failures by the expenditure there of some 2,000,000 pesos by the Government in the construction of the Canal "Rosales." When the great Cananea copper mines opened up in August, 1922, after a year and a half of inactivity, the rush of people from all parts of Sonora to Cananea in search of work amounted to a stampede, the number being estimated at about 12,000 people, many of the men being accompanied by their families.

The general destruction of sources of wealth during the past 10 or 11 years has created a temporary surplus of labor throughout the West Coast. The sugar plantations and mills, tomato planters, etc., have enough labor for the time being at 1.50 pesos ($0.75 United States currency) per day, and the men are doing better work and averaging more days a week on the job than ever before—from sheer necessity. In the old days the only effect of better wages for farm labor was that the men worked fewer days per week. The people are poorer to-day than ever before.

A result still worse than those already mentioned is the fact that the revolutions stopped the influx of American capital and energy on the rich lands of the river valleys, and on account of the inability of the West Coast to ship to the interior of the country production has languished, except that of sugar, which was stimulated by the high prices obtained during the war in Europe.

The ultimate solution of the problems presented by conditions on the West Coast is involved in the national political and educational problem, and it also goes deeper into the fundamental characteristics of the people themselves. The prospect of evolution by means of education is viewed with marked skepticism among even the better-informed Mexicans themselves.

It is true that the younger men of the better class on the West Coast are manifesting much more of the spirit of initiative than ever before. Many of them are now going in for tomato and winter-vegetable planting and other agricultural development, but their efforts are handicapped by inexperience, lack of local and national means of scientific assistance, lack of sufficient local capital and banking facilities, and the ever-present labor problem, arising now not so much from actual lack of workmen as from the general inefficiency of the men themselves. The rehabilitation of the West Coast of Mexico depends, first, upon the ability of the present national political régime to consolidate the country under a new and fundamentally sound system of government (thus doing away with the ever-present fear and general lack of confidence and bringing in its wake new investment and financial assistance), and second, the return of the American investors and settlement of the land in the various valleys by producing foreigners.

Another factor that has also been pointed out previously is the necessity for the development of standard products for export. It is still a question whether the new industry of winter tomatoes and vegetables for the American market, which has been increasing so rapidly during the past few years from the Fuerte Valley south to that of the Santiago in Nayarit, can be developed into a permanent industry. The market certainly exists and would increase in demand volume in the United States if better selection, packing, and shipping methods were applied. The Mexican tomatoes and winter vegetables do not compete with those of the United States (from California and Florida); the former come onto the market about two months earlier. The main difficulties are (1) the fact that almost 90 per cent of the tomato investment is purely promotion money from the United States (California) and (2) the problem of securing anything like adequate measures to combat insect pests and plant disease in the tomato region, necessitating organization and teamwork among the growers, something to which the Mexican people are entirely foreign by nature and through lack of experience.[1]

(On account of the importance of the labor factor in mining and agricultural development in the West Coast territory of Mexico,

[1] For more detailed analysis of the racial characteristics, tendencies, and fundamental social conditions of the Mexican people, reference is made to The People of Mexico, by Wallace Thompson, pp. 338–341, etc. For an analysis of the general economic-political-financial situation in Mexico of the present day, reference is made to Mexico: Its Reconstruction, by Chester Lloyd Jones, D. Appleton & Co., 1921. For a treatise on labor and sociological conditions of Mexico which also applies very aptly to the West Coast section of that country, reference is also made to the work of Percy Alvin Martin, Ph. D., of Stanford University, appearing under the title of "Labor conditions; Educational system" in Section VII, Mexican Year Book, 1920–21, by Robert Glass Cleland.

more details will be given under those headings farther along in this survey.)

## LIVING CONDITIONS.

The same great contrasts in the living conditions of the various classes of society that are seen throughout Latin America obtain in the Mexican West Coast region. The people of the wealthy class live in well-built Spanish-style houses constructed of brick and stucco, with modern plumbing installations made possible by the facilities of the cities where they reside. Nearly all the towns of 5,000 or more inhabitants have electric-lighting and ice-making plants. Nogales, Hermosillo, Guaymas, Culiacan, Mazatlan, and Tepic have clubs for social gatherings and recreation. The people of this class are also well traveled and usually spend several months of the year during the hot rainy season in California. In their dress, styles, etc., they are like the people of the United States, and their demands are about the same.

The middle class also lives in the cities and towns in houses like those of the upper class, but not so large or well appointed.

The lower classes are congregated in dwellings of a poorer sort on the edges of the towns and cities, or live in palm-thatched mud-wattled huts called "jacales" around the larger houses of the owners of the "haciendas." On the community lands there are numerous small villages comprising houses of this class. In these dwellings the doors and windows are merely openings in the walls; there are no floors, and the furniture is limited to a wooden-frame cot, laced with rope or rawhide, and an open-air cooking arrangement with the inevitable "metate" stone for grinding the corn used for the "tortillas," the universal food. The clothing of the men is made by hand from cotton cloth of the country, and the blanket is at once overcoat, raincoat, and bed at night, and is made sufficient for all needs of cover. Numerically, this class constitutes the bulk of the population, possibly 70 per cent of the total, and its per capita purchasing power as regards imported goods is very low, being limited to drugs in small quantities, articles of cheap ornament for the women, and a few tools, mostly machetes. These people do not wear shoes, while persons of the upper class either wear the finest imported American shoes or patronize the many small shops of the cities for their specially made footwear. People of the middle class are all wearing shoes now, but of the cheaper domestic kind which sells for about one-half the price of imported footwear, which is high priced on account of the import duty designed to protect the native industry.

Even with the coming of the railway the "peon" has not changed much, if at all, in any respect, but the educated class is becoming rapidly more modern in many ways. The style of furniture in the houses, the decorations, etc., have always been those of the Continent, more Latin than American, but this order of things is beginning to give way to American styles. The metal bed is now universally used, and one sees standard lamps, mission-style furniture, tapestry furniture, etc., in increasing numbers.

The people of this class are also very much interested in new things—new electrical appliances, new styles, new inventions—and their contact is with California. In every city home where they can be afforded electric fans are found now, and this article has become

one of first necessity to this class of the people during the hot months of the year. The demand for clothing and merchandise of all sorts is the same as that in the United States, modified only by the limitations of the market itself and the climatic conditions.

## FOREIGN POPULATION.

### CHINESE RESIDENTS.

The Chinese have long been, numerically, the largest foreign element on the West Coast of Mexico, and their numbers have considerably increased, instead of diminishing, during the past 11 years of disturbances in Mexico, and more of them are still coming. Even prior to 1910 there were more than 1,200 Chinese on the West Coast, the largest colony being located at Guaymas, where they practically controlled the grocery trade and were branching out into dry goods, shoes, etc. The Chinese also engaged in truck gardening and gave the people of the West Coast towns and cities their first adequate supply of green vegetables.

When cotton became "king" in Arizona and the Imperial Valley of California and the adjoining Mexicali Valley a few years ago (see p. 303), about 5,000 Chinese were imported to work the cotton fields on the Mexican side of the line on the leasing system. When the bottom dropped out of the cotton market in 1920, many of the Chinese drifted farther down into Mexico, not being able to enter the United States, and numbers of them have joined the Chinese colonies at various points and located more or less permanently—the West Coast of Mexico, on account of its proximity and the already established colonies, receiving the greater number of the newly arriving Chinese. The number of Chinese on the West Coast to-day—that is, in the States of Sonora, Sinaloa, and Nayarit—is not accurately known and is not shown in the rather incomplete census returns of November, 1921, but estimates show, in round numbers, something like 3,500 of them, the largest colonies being located at Guaymas and Mazatlan, with others scattered in all towns of the West Coast.

The Chinese are laundrymen, truck gardeners, etc., and engage in nearly every possible line of business endeavor, such as grocery stores, soft-drink places, general stores (handling principally dry goods), and they have a large tannery and shoe factory at both Guaymas and Culiacan and another small one at Mazatlan. The largest grocery and food store in Culiacan is owned and managed by Chinese, representing one of the largest commercial investments in that city to-day. In August, 1922, a shipload of Chinese immigrants to Mexico were refused entry into the country at the port of Manzanillo by the National Government of Mexico. In Sonora "tong" war disturbances among the Chinese, due to political factions and sympathy with the revolutionary Chinese governments, caused the deportation of more than 200 of them by the State government, the men being held at Mazatlan for a steamer to China.

While many of the Chinese marry native women and raise families in Mexico, they live very much to themselves, being clannish in the extreme and very uncommunicative to Mexicans and to other foreigners. Most of these Chinese work to acquire sufficient wealth to return to China to pass their remaining days in comfort in the homeland.

It is a growing custom among the Chinese of the West Coast to take Spanish names for business reasons and also for greater facility in communication with the natives.

Most of the Chinese of the West Coast retain their "tong" and "association" relations—San Francisco, Calif., being their headquarters in the United States, their center for financial capital, to a great extent, and also a clearing house for their business activities. They also engage in the exportation of certain Mexican products, such as dried shrimp, sharks' fins, etc., to China. By far the greater portion of their merchandise is purchased in the United States, the largest volume of their business in this line being handled through the main offices of their mutual associations in San Francisco. A great many of the Chinese stores of the West Coast are, in reality, branches of an association with headquarters in San Francisco. There are, of course, a number of independent merchants who import direct for their own account, but not all of this class can be listed as good credit risks, and Chinese merchants' accounts, unless their actual affiliation in the United States is known, should be carefully investigated before shipment of merchandise in case the order is from a customer previously unknown to the exporting firm. Long-established Chinese firms are equal to the best native credit risks, if the usual business rules are applied.

In trade the Chinese are now a very important factor throughout the West Coast, the volume of their aggregate business being almost equal to that of all the native Mexican merchants, and it is therefore important that American exporters interested in increasing their sales to the West Coast territory of Mexico should cultivate relations with them in every possible way, preferably first through direct contact with their head offices in San Francisco, which control most of the commercial activities (of any considerable volume) of the Chinese in this region. The American people and nation have the reputation among them of being champions of the Chinese race the world over, and they are very appreciative of good treatment and become excellent, steady customers of export houses when they are convinced that they are being accorded just and honorable treatment on an equality with the other importers of their community.

The Chinese storekeepers buy very few, if any, goods from the local wholesale importing houses such as the larger and long-established German firms of Mazatlan, preferring to buy direct, or through their association in the United States. They extend credit to the retail buyers locally.

The main difficulty encountered by American firms desirous of selling on the West Coast to the Chinese is their inherent characteristic of secretiveness and lack of understanding of the real value of a credit statement to serve as a basis for credit extension and commercial operations to the satisfaction of both parties. They fear local excessive taxation and can be persuaded to give out a statement only after becoming well acquainted with the representative of the house that is trying to sell them goods. It is therefore better and easier for American houses to make direct arrangements with the central Chinese association offices in San Francisco. However, they are very shrewd and careful buyers, and it takes some time and careful effort to develop business through these channels.

In order to facilitate their business affairs in the United States it is usual for these associations to have some trusted American representative who acts for them and whose introduction is worth a great deal. A fact not very well known is that the central "associations" actually force members and branches to take care of delinquent accounts and to do a uniformly legitimate and clean business—the effect of the associations being very beneficial and of far-reaching influence. The affairs of these mutual cooperative associations are handled by a regular board of directors who dictate the general policy and pass upon the acts of the various branches and members, their American adviser being frequently consulted and his advice taken.

In the port of Guaymas, and also in Hermosillo and Nogales, the Chinese have dominated in the retail trade, having branched out into general dry-goods lines during the past 10 years, and this is becoming true also of such centers as Culiacan and Mazatlan; so that the Chinese, despite their difficulties arising from racial feeling, inadequate protection, etc., are increasingly important commercial factors on the West Coast of Mexico to-day on account of their ability to survive in business during the frequent political disturbances through which the country has passed during the past 10 or 11 years, This is due to a very great extent to their system of cooperative business among themselves, and also to their extreme economy and frugality, which enables them to conduct a business with less overhead expense than any other people.

The future status of the Chinese in Mexico is very doubtful. The present administration in Mexico is known not to look with favor on Asiatic immigration. The Chinese have not proved very successful at heavy agricultural work on a large scale such as is required for the opening and planting of cotton land in the Imperial Valley on the Mexican side of the line, and the latest and most successful development there has been accomplished by large American cotton-growing syndicates employing native Mexicans under American supervision, the work proving much more satisfactory than under the first-tried Chinese leasing system. More Chinese in the Mexicali region would eventually mean more of them down the West Coast of Mexico and also in the United States.

### JAPANESE COLONIZATION.

The first Japanese to locate on the West Coast of Mexico was a Japanese doctor, who established himself 13 years ago in Culiacan, where he has remained and has been followed by a Japanese dentist, another Japanese doctor, and one Japanese civil engineer, who has purchased land in the Culiacan Valley and is now engaged in agriculture. There are also one or two Japanese professional men in Mazatlan, and one engaged in mining farther down the coast.

Two efforts at colonization on the West Coast by Japanese have failed for various reasons, and the Japanese Government until recently would not issue passports to its nationals for Mexico on account of the disturbed conditions in the country.

There is under way at present an effort to bring large numbers of Japanese into the Mexicali Valley in Lower California for land development and colonization there. It may be supposed that interests owning large areas of the Mexicali Valley lands are interested, since their great problem is that of securing sufficient labor on

some practical basis for working the now undeveloped land on a large scale, and this labor can not come from the United States under present conditions, nor can the land be cut up and sold to American investors or farmers on account of the existing Mexican land law affecting foreign ownership of land so near to the border of Mexico. Inasmuch as a well-conducted and carefully selected and planned Japanese land colonization scheme failed in the Santiago Valley (the best part of the entire West Coast) because of the advent of the period of revolution and the inability of the promoters to attract either immigrants or capital from Japan, it is very doubtful (in view of Japan's interest in the development and colonization of Korea and certain regions of China, so much nearer home, and the lack of adequate capital in Japan) whether any colonization scheme for Japanese on the West Coast of Mexico will be possible for some time to come.

In view of the inability of the American investors in large tracts of fine valley lands in the river valleys of the West Coast to realize anything on their investment for the past 11 years on account of the disturbances in Mexico and the present very unfavorable legislation affecting their titles and properties, they would probably be very glad to sell their land holdings to the Japanese or any others who might be induced to purchase under present conditions, but such buyers are lacking.

(For a report on the Japanese colonization efforts on the West Coast of Mexico, see p. 167.)

### OTHER FOREIGN POPULATION.

Prior to 1910 there were many Americans scattered throughout the West Coast, the mining men having come first, making the coast towns their headquarters for their prospecting and mining operations in the interior districts. With the construction of the railway down the coast from Guaymas in 1909 several thousand Americans came into the coast country and many of them purchased land, principally in large tracts from the Mexican owners, with the object of subdividing and reselling it to American farmers. Large irrigation schemes were planned and several were started on a great scale, attracting agricultural colonies of Americans whose inducement was that of cheaper land than could be secured in the United States. At the beginning of the revolutions in Mexico there were estimated to be more than 1,000 Americans on the West Coast of Mexico, engaged in mining and land enterprises, as well as the numerous employees of the Southern Pacific Railroad of Mexico (West Coast Line). During the first, or Madero, revolt, the property and lives of foreigners were fairly well respected by the revolutionists throughout the country, but, with the succeeding revolutions, many Americans were killed, others were forced to leave the country, and properties were stolen or destroyed. A few of the hardier ones stayed, and many of them returned to the West Coast during each short era of peace in Mexico, hoping that a new stable government would be established. Numbers of these Americans had spent the greater part of their lives in Mexico, and it meant hardship and ruin to abandon their holdings and hopes for the future.

With only a few exceptions mines were shut down all over the West Coast zone, and the only agricultural colonies of foreigners (Americans) that continued to exist were those of the Yaqui and

Fuerte (Los Mochis) Valleys, with some 40 families each, and even these were forced to abandon their lands several times. With the growth of the winter tomato and vegetable industry on the West Coast during the past few years, and, with fairly peaceful conditions obtaining during the Obregon régimé, many Americans, attracted by the opportunities for profit, are again going down the coast. Large mining companies are sending out engineers to look up likely mining properties, and it is estimated that about 90 per cent of the money being devoted to the production of winter tomatoes and green vegetables on the West Coast is American money, directly or indirectly invested. There are many projects in mines, hydroelectric plants, irrigation of valley lands, etc., under consideration by Americans who know the conditions of the West Coast territory very well, and only favorable legislation and peaceful conditions in Mexico are needed to bring about the resumption of the development of the West Coast by Americans. However, this development will necessarily be slow.[2]

The Germans and Spaniards have long been established in trade on the West Coast, with their headquarters at Mazatlan, where they have continued to do a large business despite the conditions brought about by the World War and the revolutions in Mexico. Few Americans have engaged in trade activities on the West Coast or in Mexico in the past, but latterly several American commercial enterprises have entered the field with stores and agencies and have been doing fairly well despite their handicap of small capital. The greatest commercial influence is, of course, that of the large German and Spanish houses located at Mazatlan. These firms have the very great advantages of having been long established in the country and of possessing adequate commercial capital and credit, a thorough knowledge of the standing of local people, and the ability to handle products of export in the most profitable manner. Since the beginning of the World War the largest volume of their business has been with San Francisco, Calif., and they now maintain branches as far north as Navojoa, Sonora, and as far south as Acaponeta, Nayarit, controlling the largest volume of trade as far as the radius reached by the border houses at Nogales.

Several of the large French dry-goods firms of Mexico City maintain branches under their own name, or through affiliated concerns, in Guaymas and Mazatlan. There are a few Syrian merchants established in the various trade centers of the West Coast, but none of them are very large.

British interests have the small narrow-gauge railway which connects Culiacan with Altata, the water supply of Mazatlan, and one or two land interests. The number of the British on the West Coast is very small, possibly not more than 10 persons in all.

The Germans have invested in breweries at Mazatlan, and one old German house has coquito-nut plantations and coffee plantations in Nayarit, as well as a soap factory there, near the coast. The Germans number about 45 individuals on the entire coast.

The Spaniards have about the same number, their largest group being located on the Aguirre properties in Nayarit, with their com-

[2] The aspects and effect of the existing land laws and foreign ownership, etc., are more definitely treated on pp. 164 and 167 of this report.

mercial men at Mazatlan, and a few others scattered up and down the coast, with only a few isolated individuals in the interior.

By far the largest number of Americans are located at the various large mining camps such as Cananea and Nacozari and on the valley lands of the rivers, principally at Los Mochis, in the Fuerte Valley, and in the Yaqui Valley. There are not half a dozen permanent American residents to-day in Hermosillo, and about the same number at Guaymas, aside from the employees of the Southern Pacific there and at Empalme, the railway shops and repair center for the West Coast Line. At Culiacan about a dozen Americans are living—principally men interested in mining and agricultural enterprises—and there are about twice as many located in Mazatlan. Tepic has only two or three as residents, although more American mining men are now visiting that section of the coast than ever before. The Americans engaged in agricultural work on the West Coast, including the newcomers interested in the tomato and winter-vegetable industry, may be estimated, for the entire coast territory, from the Yaqui Valley to Tepic, at about 300, in all, at the present time.

### DISTRIBUTION OF AMERICANS ON WEST COAST.

In order to convey some idea of the distribution of Americans in Sonora, there is given below a condensed copy of the register on file at the American consulate at Guaymas for the year 1921, this being the only available record:

| Location. | Industry. | Number of men. |
|---|---|---|
| Alamos | Mining | 23 |
| Cajeme (Yaqui Valley) | Agriculture | 53 |
| Cocorit (Yaqui Valley) | do | 6 |
| Empalme | Railway shops | [1] 100 |
| Esperanza (Yaqui Valley) | Agriculture | 10 |
| Guaymas | Commerce, etc | 14 |
| Hermosillo | Mining and commerce | [2] 40 |
| La Colorada | Mining | 3 |
| San Javier | do | 10 |
| Navojoa (Mayo Valley) | Agriculture | 15 |
| Total | | 274 |

[1] 35 with families. [2] Includes persons in interior.

The railway shops are now employing about 150 men. The above table covers the district from north of Hermosillo to the Sinaloa line on the south.

### ATTITUDE OF NATIVES TOWARD FOREIGNERS.

The Spaniard, of all the foreigners in Mexico, knows best how to deal with the natives. He has the most intimate understanding of their racial and national psychology. Spaniards are accepted in the best social circles of the country; frequently they marry into the best Mexican families and become identified permanently with the region where they are located in business.

The Germans are undoubtedly the best liked of all foreigners on the West Coast. Many of the younger men brought out from Germany by the large commercial houses have married native girls. They become permanently identified with their communities and

are almost invariably of a high type. They adopt the continental manner, which is pleasing to the Mexicans, and they do not mix in politics in any way. The Germans lost something of their prestige during the World War. Commercially, they also made too much of the prospect of Germany's coming back as an export nation soon after the war, and their failure to accomplish deliveries of goods has injured them commercially to the advantage of the United States.

The United States has been more or less unfortunate on the West Coast as regards the regrettable personal characteristics of some of the Americans who have gone there. The Mexican people and the resident American colonies have suffered from certain types of "floaters" on the West Coast. It is also a fact that the average Mexican, even of the cultured class, does not fully understand the general American attitude.

However, this general attitude is becoming less apparent. The better educated and more traveled of the Mexicans of the West Coast have become acquainted with certain vital economic principles during the past 10 years through a forced recognition of the conditions in their own country and a comparison with those in the United States; they now are more willing to admit the patience and tolerance of the American Government and people, and are also more frank in stating their opinion that American investment and enterprise is absolutely necessary for the development of the West Coast's natural resources in minerals, lands, and industries.

The general attitude of the Mexicans of the lower and middle classes of the West Coast is one of marked dislike of all foreigners. However, foreigners (Americans) are tolerated by the people because they have the reputation among them of paying better wages than Mexicans for the same service and of paying higher prices for nearly everything needed by them in the country. Many Americans have been able to build up very loyal organizations among the natives in mines, etc., by their policy of fair and just treatment of the working class.

As American firms now have what amounts to a monopoly of the trade of the West Coast, the future status of Americans there depends upon a change in the attitude toward foreigners in general and Americans in particular by the Mexican Government and the enactment of favorable legislation affecting ownership of land by foreigners in Mexico. Nearly every tract of land on the West Coast is for sale at a price to Americans; the native owners, as a general rule, lack the energy, knowledge, ambition, and vision, as well as the capital, with which to develop their properties, and with few exceptions they would greatly prefer to turn their holdings into cash and retire to live in either California or Mexico City.

Most of the land of the Yaqui and Fuerte River Valleys and 75 per cent of the irrigable land of the Culiacan Valley is already controlled by Americans. The native owners can find purchasers for their lands only among Americans or other foreigners. The future of the West Coast lies in the development of its potential agricultural resources, and rapid development can be brought about only by foreign investment and resource. If left to themselves the people of the West Coast will probably make no substantial progress in developing the natural resources of the territory for many years to come.

The landowning class, which includes also the professional men, controlled the Government during the Diaz régimé, but this is no longer true, the Government, both National and State, having passed into the hands of the more aggressive element of the middle and lower classes, among whom there are many extreme socialists; but the West Coast (fortunately under a strong and conservative local governor) has not yet suffered from the dominance of this element.

## INDIAN TRIBES.

The various aboriginal Indian tribes of the West Coast territory are scattered over a wide area, and their numbers are much smaller than is popularly believed. The tribes are different in appearance and characteristics, but all are dark brown, not the "red" Indians of North America—the famous Yaqui Indian of Sonora being a cousin of the Apaches of Arizona and New Mexico, who were not like the Indians farther north and east in the United States.

The Tahumares and Tepeguanes Tribes inhabit the high mountains in central and southwestern Chihuahua on the Pacific-watershed side of the range. Their headquarters towns are Barborigame (west of Guadalupe y Calvo) and La Colorada. These Indians plant some corn and wheat in the stream bottoms in season, have a breed of small cattle, and work about the mines cutting timbers, etc., at times, but not as a usual thing. Their actual numbers are not known, and their economic value is extremely small.

Remnants of other tribes exist in Sonora, but the most famous and numerically important tribe is that of the Yaqui Indians, noted for their guerilla warfare against the Mexican Government for many years. These Indians have now been allotted lands on the north side of the Yaqui River west of the railway, where they have formed five or six pueblos for agricultural pursuits. Some 4,000 of them have been gathered into these pueblo villages, about 700 are still on the warpath to-day, and several thousand more are in the Mexican Federal Army, stationed in and about Mexico City, where they constitute the nucleus of the military organization as it exists at present. Although they have been given good river bottom land with water for irrigation, tools and implements, and a food ration by the Mexican Government, they have not developed their new lands to any extent, and fresh depredations in the interior are common again. It is the consensus in Sonora that only by the removal of these warlike Indians will life and property be at all safe in the State, except under the guns of garrisoned towns and more important railway points. Several Americans have been driven off their improved lands by the Yaquis lately in the Yaqui Valley. (See "Agriculture.")

The Mayo Indians inhabit the Mayo Valley in southern Sonora and the valley of the Fuerte River in northern Sinaloa. There are few full-blooded Mayos left. They are an agricultural people and peacefully inclined. Their lands have long been held under the ancient colonial community land system. They are the chief workers in the "garbanzo" fields and also plant small fields of this chick-pea themselves, independently. Their actual numbers are not known, as they have merged into the Mexican population by intermarriage.

No vestige, in pure blood, of the once strong Culiche Tribe remains in the neighborhood of Culiacan, in Sinaloa, these Indians (a power-

ful tribe at the time of the conquest of Mexico) having undergone the process of racial fusion.

In Nayarit full-blooded Indians are found in several places, and their numbers cause them to dominate entire regions of that State. A numerically small but united tribe inhabits the Berberia Range of mountains in the extreme eastern part of the State. These people hold their intercourse with the towns lower down, maintain their old aboriginal customs, and have never been Christianized. The Indians of Esquinapa in the northwestern part, near the coast, engage in fishing almost exclusively and are the largest producers of dried shrimp for export. Other Indians inhabit the coast region north and south of the port of San Blas in Nayarit. These people gather the "coquito" oil nut for sale to the soap factories locally and for export and trade in the city of Tepic, where hundreds of them are always seen on the Sunday market day. Under the new agrarian laws of Mexico they have claimed the coquito-nut natural plantations as their property and have recently burned off large areas of this valuable export product in retaliation for not being given full possession of these lands, which have long been under title from old Spanish Crown land grants. In the State of Nayarit, while exact figures are lacking, pure-blooded Indians probably constitute at least one-fifth of the total population of the State.

These people understand little or nothing of government, have no education, are not progressive, and are economically of small value to the community at large. In the towns and on the ranches they are being slowly absorbed into the mass of the Mexican population by intermarriage.

## EDUCATION.

There are many conflicting opinions regarding the relation of the lower classes of the Mexican people to modern education—referring, of course, to the bulk of the population, which is of predominating Indian blood. These people have retained the characteristics of their ancestors, the Indians of the country, and any advance in popular education must be a slow process. The Diaz Government was universally accused of paying too little attention to this important part of the national welfare and development, but it is a question whether the inherent indifference, apathy, and dislike for change among the people themselves, together with their well-known racial characteristic of passive resistance, were not more responsible for the lack of educational advancement.

The various revolutionary governments since that of Diaz have laid great and far-reaching plans for the education of the masses; efforts have been made to put a school in every ranch and village of the interior, however remote; and increasing appropriations have been made by the National and State Governments to finance these efforts. It is regrettable that the present economic depression of the country will force this program to be amended, for the time being, on account of the lack of funds.

### POPULAR EDUCATION IN STATE OF SONORA.

Educational statistics are lacking for Sinaloa and Nayarit, but those of the State of Sonora give a very fair idea of what has been accomplished since 1907, and about the same proportions apply to the other States mentioned. In Sonora it was even proposed to send an ambulant school into the country districts, "a school on wheels," but this was found impractical on account of the nature of the country and the lack of roads.

The greatest educational factor for the West Coast has been the railway, which has brought formerly isolated communities into touch with the rest of the territory, up and down the coast; and there is also the general effect of the example to the people afforded by the foreigners (Americans) who have introduced modern agricultural methods.

Following are figures relating to popular education in Sonora:

| Items. | 1907 | 1912 | 1917 |
|---|---|---|---|
| Primary schools: | | | |
| Boys' schools | 92 | 102 | 133 |
| Girls' schools | 61 | 62 | 100 |
| Coeducational schools | 25 | 103 | 108 |
| Total | 178 | 267 | 341 |
| Professional schools: | | | |
| Normal school | 0 | 0 | 1 |
| Agricultural school | 0 | 0 | 1 |
| Normal academies | 1 | 1 | 3 |
| Special schools: | | | |
| Academy of arts | 0 | 0 | 1 |
| Industrial arts and trades | 0 | 0 | 1 |
| Number of pupils | 10,804 | 13,211 | 24,187 |

| Items. | 1907 | 1912 | 1917 |
|---|---|---|---|
| Employees: | | | |
| Inspectors | 1 | 3 | 9 |
| Directors (teachers) | 178 | 267 | 341 |
| Assistant teachers | 147 | 145 | 427 |
| Professors, special class | 14 | ..... | 68 |
| Total | 340 | 415 | 845 |
| School budgets of Sonora: | *Pesos.* | *Pesos.* | *Pesos.* |
| By State government | 102,638 | 270,000 | 1,408,336 |
| By municipalities (counties) | 128,686 | 323,985 | 75,000 |
| Private sources | 16,630 | ..... | ..... |
| Total | 247,954 | 593,985 | 1,483,336 |

In 1920, the school appropriation of the State of Sonora was 1,600,000 pesos—15 times larger than the State educational appropriation prior to 1910, showing an average expenditure of 6 pesos per capita, based on the total population of the State, and amounting to approximately one-fourth of the total annual appropriation of the State. The school budgets of Sinaloa and Nayarit have carried out about the same average proportion of expenditure for popular education. It should be understood, however, that the various revolutionary activities during the past years have seriously interfered with this program and necessitated that the money set aside for the schools be used for military purposes from time to time, with resulting nonpayment of teachers' salaries and general disorganization. For example, during the summer of 1922 education in Sinaloa and Nayarit was at a low ebb because all available funds were being taken for the military operations against the rebel, Juan Carrasco, then operating in the southern part of Sinaloa.

The State University, Colegio Rosales, at Culiacan, Sinaloa, was closed definitely in August, 1922, on account of the lack of funds. This old and excellent institution had been the pride of Sinaloa and had turned out some good engineers, doctors, etc., in its time. Such little money as remained in the State treasury after meeting military demands at the time went toward the completion of the Rosales Canal in the Culiacan River Valley. From time to time the State Government, assisted by the Federal Government, has sent missions to the United States to study higher educational methods with the idea of improving the Colegio Rosales, but these efforts, on account of local conditions and lack of funds, have always come to nothing in the past. Such a condition of affairs is also due to the general lack of cohesion and support of such an institution on the part of the educated and well-to-do people of the community, who seem to think that this is a matter for the Government to solve in its own way and who prefer, as a rule, to send their young men to Mexico City, Guadalajara, or the United States for higher education.

From the above table it is seen that the State of Sonora included, in its budget for 1917, 1,493,335 pesos as its total expenditure for education in the State that year.

For the fiscal year ended June 30, 1922, the total disbursements of the State amounted to 2,770,710 pesos, or 230,892 pesos per month, and the total income from all possible sources was only 130,000 pesos per month, giving a deficit of more than 100,000 pesos per month, or nearly 50 per cent. All possible sources of income by taxation are already overburdened with taxes, ordinary and specially created for emergency purposes of the State administration, and it is not possible to create new sources of revenue at this time. The result

is that popular education in Sonora must languish for the time being on account of the general lack of sufficient funds, and this same condition also applies to both Sinaloa and Nayarit, where State finances are in much the same condition. The same remarks are applicable to the national educational program. Large orders for equipment for schools, contracted for in accordance with the new and far-reaching program of 1922 under the new minister of education, can not be paid for on account of the lack of funds; and in view of the general economic condition of the country after more than 10 years of destruction of the means of production and wealth, it may be concluded that real improvement in Mexico's educational system will be a matter of slow development for some time to come.

### SUPPORT BY FEDERAL GOVERNMENT.

Under the new popular educational program of 1922 a corps of educational missionaries was formed, its purpose being to travel throughout the country and instill into the minds of the lower classes, by means of propaganda, the idea of education for their children. One such lecturer toured the West Coast in the summer of 1922.

### VOCATIONAL SCHOOLS.

Several of the revolutionary leaders have founded industrial schools for the orphans of the revolutions. By popular subscription, the Governor of Sonora raised a total of $211,752 by the end of July, 1919, with which the "Cruz Galvez" school system was started at the State capital, Hermosillo. Eight separate buildings were erected on a tract of 5 hectares (1 hectare = 2.47 acres) on the outskirts of Hermosillo, for the following departments: Classrooms, service department, dormitories, baths, infirmary, machine shop, shoe shop, graphic-arts shop. The total present capacity is 500 pupils. Besides elementary and superior education, the children receive instruction in stenography, languages, music, printing, joinery, cabinetmaking, shoemaking, tanning, and machine-shop work.

The shoe factory has a capacity of 400 pairs daily and is self-sustaining. The machinery equipment is modern in every respect and of well-known standard American make. The printing establishment was discontinued in the summer of 1922, the plant being leased to the newspaper, Diario de Sonora, of Hermosillo. It was planned to extend this system throughout the State as rapidly as possible, but the present general economic condition of the State precludes this being done for some time to come, and it is feared that the present institution will deteriorate for lack of sustained popular interest in its development.

The Mexican people of the lower class are usually clever hand-workers and make excellent factory operatives on work where patience and manual dexterity are required. They become proficient in cotton mills, shoe shops, furniture factories, and the like, and many of them show natural mechanical talent and inclination. Nowhere in all Latin America do the people of the country show such skill as the Mexicans in the output of a variety of articles made in the household. It is generally thought that the immediate need is for industrial education in Mexico in order to develop and make economically effective this inclination of the people.

### FOREIGN SCHOOLS—RELIGIOUS SCHOOLS.

In the territory covered by this handbook, three schools—at Hermosillo, El Fuerte, and Mazatlan—are now being conducted by missionaries of the American Board (Congregational) and its affiliated women's boards. The school in Hermosillo, the Instituto Corona, has recently erected a $12,000 building. It has an enrollment of about 98 pupils, boys and girls, with two American and five Mexican teachers. The school at El Fuerte, Escuela El Progreso, has two American and five Mexican teachers and enrolls about 130 pupils of both sexes. Escuela El Pacifico, at Mazatlan, gives instruction in Spanish and English to children and adults in day and night classes. It has one American and two Mexican teachers and enrolled 72 pupils in the school year 1922–23.

The southern Baptists of the United States maintain a boarding school in Guaymas, with four American and a number of Mexican teachers.

One German school is operating at Mazatlan and has 132 boarding pupils from the surrounding country. A branch of this institution is planned in the near future for Culiacan.

At Empalme a school is maintained for children of employees of the Southern Pacific Railroad of Mexico. At El Tigre, Sonora, there is a school taught by an American woman and supported by the mining interests. At Los Mochis two schools with American teachers are maintained, respectively, by the United Sugar Co. and the ranchers in the Fuerte Valley. A similar school is maintained on the Richardson Construction Co. project in the Yaqui Valley.

Religious schools, formerly numerous and teaching possibly 25 per cent of the children, are now discountenanced by the policy of the National Government.

### EDUCATION OF MEXICANS IN THE UNITED STATES.

The religious schools of Los Angeles, San Francisco, and St. Louis, Mo., have always attracted a considerable number of Mexicans. During the past 10 years of internal strife in Mexico, great numbers of West Coast and Chihuahua families have resided in the United States, the largest numbers being located in southern California, especially in Los Angeles, with the result that the schools there are educating an increasing number of Mexican children each year. The private schools of Los Angeles are also receiving many more young Mexicans than ever before. Because of the much larger per capita expenditure for education in the United States, it may be advanced, as an opinion, that more money is being expended on the education of Mexicans in the United States (that is, in Arizona and California) than in the three States that form the Mexican West Coast territory.

### COMMERCIAL SCHOOLS.

There is one private commercial school in Hermosillo (La Escuela Comercial H. Aja) and another in Mazatlan (Colegio Comercial), each having approximately 30 pupils and teaching all commercial lines, such as accounting, bookkeeping, stenography, etc. The H. Aja school in Hermosillo has a moving-picture projection machine for educational use and has opened a polytechnic department in addition to its old branches.

## TRANSPORTATION.

### GENERAL SITUATION.

The transportation facilities, both rail and water, of the West Coast of Mexico are entirely adequate, consistent with the population and the present stage of development of the territory as a whole, except for the connection lacking between the city of Tepic, capital of the State of Nayarit, and Guadalajara, by means of which the West Coast would have direct rail communication with the central part of Mexico, This rail extension is vital to the economic interests of the entire "West Coast" because it would afford an easier outlet for the surplus products of export, such as the wheat and rice of Sonora, the corn, beans, and sugar of Sinaloa, and the corn, beans, tobacco, and sugar of Nayarit.

The West Coast of Mexico was the scene of the last great railroad construction undertaking by the line of American transcontinental railway builders, the extension of the Southern Pacific Railroad from Guaymas to Tepic, down the West Coast, being due to the vision of men like Epes Randolph, who, with others, interested the late E. H. Harriman in the construction of this line and the development of this new empire, which combines so many potential opportunities for American enterprise and capital. Revolution in Mexico stopped construction through to Guadalajara, but the West Coast was given its first adequate transportation, and stagnant communities received their first stimulus of modern commerce and development by contact with the rest of the territory and with the outer world.

The entire territory, including the States of Sonora, Sinaloa, and Nayarit, has six lines of railway. Three of these are short lines connecting interior points with the coast—(1) that of the Kansas City, Mexico & Orient Railway now operating between the port of Topolobampo and the town of Fuerte, at the head of the Fuerte River Valley, and surveyed to cross the Sierra Madre Range to Chihuahua and thence to the American border at Eagle Pass; (2) the old British railway called the Ferrocarril Occidental, which connects Culiacan with the seaport of Altata; and (3) the new Mexican Government line from Navojoa, on the Southern Pacific Coast Line, to the new proposed gulf port of Yavaros, its object being to afford a shorter means of outlet to the sea for the "garbanzo" crop of the Mayo River Valley.

The longest line is that of the Southern Pacific Co., which connects with the Southern Pacific main line at Tucson, Ariz., runs from Nogales, at the border, to Tepic, and is surveyed to Guadalajara across the difficult terrain between the city of Tepic, in Nayarit, and the Guadalajara-Manzanillo branch of the Mexican National Railways. A Southern Pacific line connects Nogales with Cananea, via Del Rio, from which place another border line goes to Naco and thence to the main line again at Benson, via Fairbanks, over a link in the El Paso & Southwestern system, which has also a connecting line from

Naco to Douglas. The Nacozari Railway (Phelps-Dodge) connects Douglas, Ariz., with the rich mining district of Nacozari in northeastern Sonora.

A short branch line connects the La Colorada mines with the main line south of Hermosillo, and the Southern Pacific Co. has built branches up the Yaqui Valley (Corral to Tonichi, projected to connect through to Moctezuma and Nacozari) and also from Navojoa to Alamos. In short, wherever development in mining and agriculture has demanded transportation, even based on latent possibilities, lines have been built to take care of the present or future needs, and the completion of the proposed systems and new construction work is dependent only on the return of stable conditions in Mexico as a whole, with favorable attitude and legislation covering the investment of foreign capital in that country.

## HISTORY OF RAILWAY DEVELOPMENT ON WEST COAST.

In the early days of West Coast development, the territory being isolated from the rest of Mexico, the problem was to provide rail connection with the nearest seaports for the inland commercial centers of Tepic, in Nayarit, and Culiacan, capital of the State of Sinaloa. The principal city to the north of Culiacan was Guaymas, a seaport, and between Culiacan and Tepic was Mazatlan, also a seaport. Through the George Douglass interests, of Mazatlan, British capital constructed a line from Culiacan to its nearest port on the Gulf of Lower California, Altata, then a fairly good harbor into which fair-sized coastwise steamers could enter in safety and which in colonial times had been used by the trading vessels from the Philippines, Acapulco, etc. This railway, the Ferrocarril Occidental, now connects with the Southern Pacific at Culiacan and serves the Culiacan Valley, the third largest sugar-producing valley of the West Coast and now provided with an irrigation canal recently completed by the Mexican Government. The line has been in operation for about 40 years.

A similar project, to connect Tepic (the capital and principal business center of the Territory of Tepic, now the State of Nayarit) with the seaport of San Blas, was started more than 30 years ago by the old Mexican Central Railway Co., which built the line from Ciudad Juarez to Mexico City and from Irapuato to Guadalajara and later to Manzanillo. Construction on the Tepic-San Blas project was never completed. The grading and rails reached the hacienda of Navarete, from San Blas, and then the work was abandoned. The present Mexican Government is planning the construction of the line between San Marcos and Tepic (now that the original Southern Pacific concession construction period has lapsed), with an extension from Tepic to San Blas. Imports into Tepic formerly came either overland from the end of the Guadalajara-San Marcos branch of the Mexican National Railways (formerly Mexican Central) by pack animal or by water to the port of San Blas and then overland in carts during the dry season to Tepic, or by pack mule in the rainy season. The Pacific Mail steamers from San Francisco, north and south bound, called at San Blas for passengers and freight. With the construction of the Southern Pacific south from Mazatlan to Tepic, passenger traffic now takes the railway, and the bulk of the commodity shipments come to Mazatlan for transshipment by rail, although

some cargo still comes down direct by steamer from San Francisco during the dry season of the year when delivery can be secured in Tepic by cart or pack animal. However, the port of San Blas is a poor one, very small, only partly protected, and vessels have to lie at a considerable distance offshore and handle cargo by lighters over a small bar to the mouth of the San Blas Creek, where the lighters land near the town.

No better description of the inception, construction, and history of the Southern Pacific West Coast Lines can be secured than that written for the Southern Pacific Bulletin, of October, 1921, by V. W. Bennett, long identified with the work and latterly division superintendent, Mazatlan to Tepic. Mr. Bennett's article follows:

With the construction of the Nacozari Railroad by the Phelps-Dodge interests in the late nineties, between Douglas, Ariz., and Nacozari, Sonora, Mexico (for the purpose of developing their large copper holdings at the latter point), with the successful organization of the Cananea Consolidated Copper Co., at Cananea, Sonora, and with the building of the railway from Naco, Ariz., to Cananea a year or two later, attention was drawn to northwestern Mexico. The old tales of the wonderful resources of the West Coast were again revived.

Under instruction from E. H. Harriman, early in 1904, J. A. Naugle, at that time assistant general manager of the Sonora Railway (Nogales to Guaymas), accompanied by Frank Kranz, a prominent mining man of Nogales, Ariz., made a trip by team from Guaymas, Sonora, to Guadalajara, Jalisco. The report made by them on their return was so glowing and so thoroughly corroborated previous reports of the latent resources of this region, that an organization was immediately formed, headed by Col. Epes Randolph, Southern Pacific Co. engineer, and the various concessions were secured under which those portions of the Southern Pacific Railroad of Mexico built subsequent to 1904 were constructed.

It might be well to state here that W. C. Green, whose organization of the Cananea Consolidated Copper Co. placed him unmistakably among the big men of the country, was one of the staunchest supporters of Messrs. Harriman and Randolph in their dream of a West Coast railway through to Guadalajara, the second largest city of the Republic, and of making connection, either by construction or trackage arrangements, from that point into Mexico City.

Let us at this point briefly analyze what the lure was which determined the spending of millions on millions of dollars on this dream, which is as yet not fully realized, but which surely will be. There is a coastal plain, averaging 30 miles wide and roughly 700 miles long, watered by 15 large rivers and various small streams, furnishing an abundance of water for irrigation. The climate compares favorably with that of California, and all crops (including fruits) that California will produce, and some that can not be produced in California, can be successfully cultivated. There is an estimated area of 3,150,000 acres of river-bottom soil and an additional tillable and irrigable area of 5,250,000 acres. This indicates only land most available for irrigation—land that can be readily brought under cultivation. A large percentage of this land will raise one crop a year without irrigation, and some of it two crops. The average richness of soil is not exceeded anywhere. Practically all of the principal rivers have suitable dam sites for controlling flood waters. The mountain range is very highly mineralized, with a number of producing mines from which millions have been taken and are still being taken. It is recalled that John Hays Hammond once pronounced the territory tapped by the Tonichi Branch as being one of the most heavily mineralized regions of the globe.

In Sinaloa three large sugar plants are in operation, each with an immense acreage still undeveloped and with an abundance of water available.

This country was served only by a daily stage line, frequently tied up for from 60 to 90 days during the rainy season, when the only means of travel by land was horseback or mule back, mail being carried in this manner. A stage trip from Guadalajara to Guaymas, under the very best conditions, was made in 11 days, the only other means of travel being by steamer, which touched only at a few points on the coast, it being necessary to land passengers and cargo by means of lighters, as there were no improved harbors between Guaymas and Manzanillo. In the face of these handicaps the country was peaceful and prosperous, as was the entire Republic of Mexico at that time. No one could foresee what was to follow.

The West Coast of Mexico route follows, in a general way, the old Camino Real, which extended from Guadalajara to Tucson at one time, and is marked by the ruins

of missions hundreds of years old. The part of the line which turns away from the coastal plain to reach the high central plateau at Tepic lies in the classic country well known to locating engineers through the description given in A. M. Wellington's Economic Theory of Railway Location, in use in many engineering schools in the country (pp. 675 to 679). Incidentally, a better line was located than the route indicated by Mr. Wellington, with a maximum grade of 2.4 per cent for a distance of 26 miles.

The first portion of the later construction now comprising the holdings of the Southern Pacific Railroad of Mexico was the line connecting the El Paso & Southwestern Railway at Naco, Ariz., with the mines of the Cananea Consolidated Copper Co. at Cananea, Sonora, Mexico, which was constructed under the direction of the Santa Fe System in the year 1901, having been taken over shortly thereafter by the Southern Pacific System interests.

The construction of the Southern Pacific of Mexico lines south of Guaymas probably marks the end of the active period of rapid and dramatic pioneer railway building in America. To recount its history would be, in a measure, to tell anew many of the instances of pioneer days of the first Southern Pacific lines, nor was there lacking the inevitable American frontiersman, nor even the hostile Indian. Four of the finest Missouri mules ever eaten—and they were undoubtedly eaten—were taken from the first surveying party on the preliminary lines on the Yaqui River by Indians who also killed two soldiers, members of the guard of 20 provided for this party. This was within a short distance of the camp.

Ground was broken in August, 1905, at a point now known as Empalme, just north of Guaymas on the Sonora Railway, which was originally also constructed by the Santa Fe System and taken over by the Southern Pacific, on the Cananea, Rio Yaqui y Pacifico concession under which the line from Empalme to Navojoa, the Tonichi and Alamos Branches, and the Nogales-Del Rio Line were built. By the first months of 1906 a full-fledged construction organization was in the field and rapid progress made.

Construction was started out of Mazatlan and also Guadalajara in 1907 under the Southern Pacific of Mexico concession from the Diaz Government of Mexico.[3]

The line between Nogales and Del Rio (see Cananea), Sonora, was built in 1907 and 1908, the Tonichi Branch was built in 1907–1910, the Alamos Branch in 1907, and the line was completed through to Navojoa from Guaymas in May, 1907—a distance of 117 miles.

Construction was pushed in both directions out of Mazatlan, locomotives and cars being shipped in by steamer; a fleet of lighters was constructed, and two tugs for their operations were brought down from the United States. Ties, redwood and Oregon pine, were shipped in by the steamer load from California and Oregon, as well as steel from Europe. At Mazatlan all material was lightered a distance of a mile and a half from alongside steamer lying in the outer roadstead to the wharf at the railway construction headquarters near Mazatlan, there being no harbor facilities, in the proper sense of the word, at Mazatlan. Connection was made with the forces working north from Mazatlan and those coming south from Culiacan, about 46 miles north of the port early in 1909. The line had been completed to the south by that time as far as the Presidio River, south of Mazatlan, thus giving a through line for operation from Empalme to Presidio, a distance of 484 miles. The line was opened through to Yago, at the Santiago River, 146 miles south of Mazatlan, May 1, 1910, and to Tepic, 196 miles south of Mazatlan, February 5, 1912.

A steamer was operated regularly between Mazatlan, Manzanillo, and Guaymas by the Southern Pacific Co. in connection with its construction work from 1908 until the destruction of the boat at her moorings alongside the wharf at Manzanillo in 1914, coincidentally with the occupation of Vera Cruz by American forces.

Taking into consideration the portion of the old Sonora Railway from Magdalena south, the line is continuous to the south for a distance of 900 miles with a maximum grade of 0.5 per cent. This probably equals, if it does not exceed, any other piece of original construction with such a low maximum grade average on this continent, and it is also worth while mentioning that there have been very few bad washouts on the line south of Navojoa—at least nothing to indicate the desirability of any relocation-of-line changes.

Construction on the West Coast Line was carried out by modern methods and appliances and excellent progress made. As much as 39 miles of grade was completed in one month and track laid on it, full tied, in the same length of time.

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[3] Concession from Federal Government of Mexico carrying subsidy of from 12,000 to 20,000 pesos per kilometer of line constructed, with 99-year operating lease. The time for construction between Tepic and Orandain (near Guadalajara) under this concession has now lapsed on account of interference with the work by the revolutions in Mexico during the past 10 or 11 years. (See also, beginning on p. 56, the account of the claims of the Southern Pacific Co. against the Mexican Government for damages, losses, services, etc., during the revolutions.)

On the Guadalajara portion the earthwork was done entirely by basket men on the piecework basis, dirt being carried in a basket on the men's backs with a head strap running up over the shoulders and over the forehead. About 120 pounds was a load and 4 cubic meters a day's work.

The Southern Pacific of Mexico is operating to-day (September, 1922) with lines from Nogales, Sonora, to Tepic, capital of the new State of Nayarit, a distance of 931 miles; from Nogales, Sonora, to the junction with the Cananea-Naco line at Del Rio, Sonora, a distance of 78 miles; and from Orendain to La Quemada, north of Guadalajara, a distance of 42 miles. That portion of the system from the city of Tepic to La Quemada, a distance of about 100 miles by rail, remains to be constructed in order to connect through to Guadalajara, which will give direct rail communication to Mexico City.

In addition to this there is a branch line from Corral to Tonichi, up the Yaqui River Valley, a distance of 97 miles (the objective being to connect with the Nacozari-Douglas Railway, via Moctezuma); one from Navojoa to Alamos, a distance of 39 miles; and another branch from Quila, on the San Lorenzo River, south of Culiacan, to El Dorado, a distance of 14 miles. Neither of the first two mentioned branch lines are, at present, in operation, for the reason that the repairs made necessary by the depredations during the revolutions and by deterioration have not been made as yet. That portion of the line from Ruiz to Tepic, out of operation for a number of years from the same causes, was put back into temporary condition in late 1921 and is now in operation.

The oldest portion of the West Coast system, known as the Sonora Railway, extending from Nogales to Guaymas, might be classed as the nucleus of the present system. This line, as well as the New Mexico & Arizona line, which extended from Nogales, Ariz., to Benson in the same State (a Territory at that time), was built between the years 1880 and 1883 by the Santa Fe System and operated by them until 1897, when a reciprocal lease was executed between the Southern Pacific Co. and the Santa Fe System covering the Sonora Railroad, the New Mexico & Arizona, and the Mojave-Needles lines. Under this lease the Southern Pacific Co. took over the operation of the Sonora and New Mexico-Arizona Railways and the Santa Fe took over the Mojave-Needles line, the New Mexico & Arizona being operated as a part of the Tucson Division of the Southern Pacific, and the Sonora Railway being operated as a separate unit until 1912, or after the completion of the Southern Pacific Railroad of Mexico as it now stands. Complete transfer of titles was made for the respective properties under lease by the Santa Fe and Southern Pacific, and the Sonora Railway was merged into the Southern Pacific Railroad of Mexico.

Although the Mexican revolution broke out before the line was completed through to Tepic, and there have been repeated interruptions of traffic and loss of crops, this section of the country has gone steadily forward.

The property has suffered greatly during the years of the revolutions in Mexico, as stated elsewhere, traffic having been interrupted frequently and for long periods. Hundreds of trestles have been burned, some of them having been rebuilt and destroyed many times. Cars and locomotives have been destroyed. There were at one time, on the Sinaloa Division, 6 miles of burned bridges. In the year 1915 there was an average of a trestle a day burned from January 1 to July 31, ranging in length from one span to 260 feet. As a matter of necessity, many of these openings have been "shooflied," there having been times when there were over 150 "shooflies" on the operated portion of the track. These have been gradually eliminated, but there still remained in October, 1921, upward of 75. Regardless of these circumstances and conditions, track and equipment are in fair condition.

Throughout all of the revolutionary periods there has been very little change in personnel, even among train and enginemen. Among the officials there has been but one case of a man resigning during this time, and in this case it was not from any sense of fear or wishing to avoid the necessary hardships.

Empalme, the field operating headquarters and repair-shop site of the Southern Pacific Railroad of Mexico, located about 2½ miles from the port of Guaymas and near the ocean, is a modern city of some 4,000 people, consisting almost entirely of railway employees and their families. The water plant, sewerage, lighting system, all of the houses, the hotel, and the club are owned by the railway company.

The principal cities along the route are Nogales, Cananea, Hermosillo, Guaymas, and Navojoa, all in Sonora; San Blas, Culiacan, Mazatlan, and Rosario, all in Sinaloa; and Acaponeta and Tepic, in Nayarit.

## KANSAS CITY, MEXICO & ORIENT RAILWAY.

### ORGANIZATION, LOCATION, AND CONSTRUCTION.

This railway was also an American railroad-building enterprise. The Kansas City, Mexico & Orient Railway Co., with headquarters in Kansas City, Mo., was incorporated under the laws of Kansas on April 30, 1900, and its lines in Mexico are operated under the "Kansas charter," which was legalized by the Diaz Government of Mexico. The company was reorganized and reincorporated in Kansas as the Kansas City, Mexico & Orient Railroad Co. on July 6, 1914. Its line in the United States was taken over by the American Government Railroad Administration during the war, in 1918, and that same year the Mexican Government took over the operation of the line in Mexico from the American border at Eagle Pass to the city of Chihuahua under a contract for a term of years.[4]

This railway, when completed, will extend from Kansas City, Mo., to Topolobampo, Sinaloa, a port on the Gulf of California—a distance of approximately 1,659 miles. The distance from Kansas City to San Francisco by the shortest route is 2,016 miles, and this new line was promoted on the premise of triangling down through a wide area of only partly developed country in the United States, of tapping a rich undeveloped territory on both sides of the Sierra Madre Range in Mexico, and of providing a shorter rail haul to tidewater on the Pacific than is afforded by any present transcontinental route in the United States.

No great difficulties of construction presented themselves over the route selected until the heavy and abrupt range of the Sierra Madres was encountered in Mexico, where seven years were spent in preliminary location work. The original plan involved a section of 40 miles of cog-railway on a grade of 14 per cent; but after two years of relocation work a more practicable route with a grade of 5 per cent was found, and finally three possible routes, lying close together, which involved grades of 2½ per cent, compensated for curves. It is probable that even this grade can be materially modified by extensive tunneling. The mountain division in Chihuahua and Sinaloa takes in timberlands and extensive mining areas where there are a number of rich mines and where mining would be greatly stimulated by the advent of railway transportation, as there are known to exist many deposits of low-grade gold ores, as well as silver-lead ores, that can not be worked at the margin of profit possible with pack-mule transportation.

In December, 1917, 737 miles of track were in operation in the United States and 234 miles in Mexico, of which 62 miles reach from the port of Topolobampo to El Fuerte, crossing the Southern Pacific West Coast Line at the town of San Blas, Sinaloa.

At present the section from Kansas City to Wichita, Kans., has been graded in portions, but trains run over another system to this point, from which Kansas City, Mexico & Orient trains operate over their own line to Alpine, Tex., where it connects with the Southern Pacific System east of El Paso. From Alpine the line

[4] The following data on the Kansas City, Mexico & Orient Railway have been compiled from the Handbook on Mexico issued by the British Admiralty in 1919, with corrections and alterations to date based on observations and information secured by research and in the field by P. L. Bell and H. Bentley MacKenzie.

has been graded as far as the present end of construction in Mexico, at Marquez, crossing the border and the Rio Grande at El Oro, east of Presidio del Norte, and following the Balsas River via Rancho Mula and Puerto Monier. From Marquez to Chihuahua trains are in operation under the management of the Mexican National Railways, and also from the city of Chihuahua to Sanchez, present terminal of train operation, trains running over the Mexico Northwestern from Chihuahua to La Junta. Grading has been done from Sanchez to Los Trigos and thence to Los Hornillos. On the Pacific side of the range the line has been graded in spots and surveyed in others east of Fuerte, this being the really heavy mountain division.

The line as at present constructed is on a ruling grade of 2 per cent, which occurs in the section to Sanchez, the present end of the line west of Chihuahua. East of Chihuahua, to the Rio Conchos, the grade is 1½ per cent. Over the West Coast section the grade is 1 per cent to El Fuerte.

The gauge is standard American (4 feet 8½ inches), and the line is laid with 70-pound steel over 630 miles and 75-pound steel over 86 miles. Sidings are laid with 60-pound rails. Ties are mostly of white oak, although replacements are being made on the West Coast section with native hardwoods found in that region. In Mexico all important bridges are of steel with concrete or masonry abutments.

### WEST COAST DIVISION.

The rolling stock of the West Coast division consists of 8 locomotives of the consolidated type, 10 passenger cars, 2 of first class, and 247 freight cars of American standard make on both sides of the range in Mexico, of 60,000 and 80,000 pounds capacity.

From Chihuahua east the West Coast Line runs 91 miles to Marquez, toward the American border at Presidio. From Chihuahua west the line, including the Mexican Northwestern division, is 194 miles long, the Mexican Northwestern section used being 114 miles long and, from La Junta to Sanchez, 80 miles long. Chihuahua City has an elevation above sea level of 4,605 feet, and Sanchez (the end of steel) 8,045 feet where the Continental Divide is reached for the third time. Sanchez is about 75 miles from Chinipas, the center of the rich Arteaga mining district, for which it forms one of the outlets, the other being Alamos. Beyond Sanchez the line will proceed through Los Trigos to Mesa (elevation 7,350 feet), near which is the famous Barranca de Cobre (a gigantic rift, or canyon, leading to the western watershed of the range), and will continue on a down grade, dropping to 656 feet at La Junta, 126 miles from Mesa, and thence to Los Hornillos, where it will connect with present construction from the seacoast at Topolobampo. From Los Hornillos the grade has been constructed to El Fuerte, a distance of 11 miles, but trains only reach Fuerte at the present time from the port of Topolobampo. Fuerte has an elevation of 328 feet above sea level, and from there to San Blas, the point of crossing with the Southern Pacific West Coast Line (elevation, 121 feet, 24 miles distant), the line has a 1 per cent grade to the coast. The distance from San Blas to Topolobampo is 38 miles, and this part of the line runs through the heart of the rich Fuerte River Valley, collecting a considerable tonnage of sugar and winter vegetables for transfer to the Southern Pacific at San Blas.

With the renewal of mining activities in the mountains north and south and inland from Fuerte and in the Alamos and Batopilas regions of the range, the Fuerte section will again carry a better tonnage than is now the case.

#### FUTURE CONSIDERATIONS.

A great deal of money has been expended on this railway, which can not be a paying venture until it is connected through the mountains and can rely upon the "through-tonnage haul." The terminus on the Pacific, Topolobampo, can not be considered a very good harbor on account of the great bar which obstructs its entrance out at sea and which will require enormous dredging operations to make the excellent protected inland bay available for heavy ocean tonnage. (See p. 17.) Enormous capital is required to construct the line over the range to connect with the West Coast section, and this capital depends upon conditions in Mexico in general. In the United States, and in Mexico until the city of Chihuahua is reached, the line runs through a partly desert country supporting a very meager population. Its tonnage in the mountain section of Chihuahua depends upon the development of lumbering and mining activities, and it is a serious question whether this line, if completed through to Topolobampo, could hope to compete with other transcontinental lines for tonnage for export from the United States to Pacific ports and the Orient, in view of the present condition of commercial development in both the United States and Mexico. At present the West Coast division is necessarily being operated as a separate unit between Topolobampo and Fuerte. Repair shops and headquarters are located at San Blas. With the tonnage afforded by the development of agriculture in the Fuerte Valley this part of the line is paying at the present time a small surplus above actual operating and upkeep expenses. Equipment and track are in very poor condition as a result of the years of revolution in that part of Mexico, and the property has suffered in depreciation and loss. The purchasing agent is the Kansas City, Mexico & Orient Railroad Co., Kansas City, Mo., where general offices are also located. American standard equipment, signals, etc., are used throughout.

### SOUTHERN PACIFIC RAILROAD OF MEXICO.

#### ROLLING STOCK AND EQUIPMENT.

During the revolutions the damage to rolling stock on the Southern Pacific Railroad of Mexico has been very great; 1,200 freight cars have been totally or partly destroyed at one time or another by the rebels and Government troops. At present the line is using a total of 64 locomotives of the standard American type, 1,313 freight cars of all types, and 86 passenger coaches, of which 16 are of first-class type. Pullman cars are carried from Los Angeles as far as Mazatlan three times a week, which is the present operating schedule.

The Sonora State government encouraged a general strike of the men employed by the company in 1917, then took over the road and endeavored to operate it for their own account. They failed in this, and financial difficulties forced them to ask the company to take the line back. This was done by the company after the government

had recognized all claims. Up to 1916, bridges totaling 75,151 feet in length had been destroyed from time to time, some of these more than once.

### SONORA RAILWAY.

In 1909, after being taken over from the Santa Fe System, the Sonora Railway portion of the West Coast Line was reconstructed. This involved the raising of the track, the putting in of new ties throughout, the replacement of old bridges and culverts, and the substitution of heavier rails. The line is now of standard American gauge (4 feet 8½ inches). The heaviest grade is 2 per cent (Magdalena division) and the minimum curve radius 574.465 feet. This part of the line has 1,902 bridges and culverts, having a total length of 34,017 feet.

### TOWNS ON MAIN LINE, ELEVATIONS, CONNECTIONS, ETC.

In the following table are brief descriptions of the principal places on the main line of the Southern Pacific Railroad of Mexico:

| Towns. | Elevation. | Distance from Nogales. | Description. |
|---|---|---|---|
| | *Feet.* | *Miles.* | |
| Nogales | 3,869 | 0 | Terminus of line from Tucson and Benson, Ariz., where connection is made with main line of Southern Pacific. Point of departure for Altar mining district and for West Coast Route as far south as Tepic. |
| Lomas | ..... | 3 | Branch line, formerly part of the Rio Yaqui, Cananea & Pacific Railway, 4 foot 8½ inch gauge, runs generally east to (4 miles) Puertozuelo, 4,910 feet; along valley of Rio Santa Cruz and across the river near Santa Cruz (36 miles), 4,439 feet; to (78 miles) Del Rio, 4,681 feet, junction with line from Naco to Cananea. Maximum grade, 2.6 per cent; minimum curve radius, 625 feet. |
| Encima | 4,188 | 7 | A general down grade from Encima to Guaymas, at sea level. |
| Agua Zarca | 3,816 | 12½ | Here the San Ignacio River is reached, its right bank being followed to Magdalena. |
| Magdalena | 2,460 | 54 | Near point where line crosses Rio San Ignacio. Wheat and cotton section; also mining to the south. Prospects of dry farming and irrigation works. |
| Santa Ana | 2,252 | 66 | Shipping point for Altar mining district, reached by auto truck, etc. Line proceeds due south across level plain. |
| Carbo | 1,523 | 130 | Lunch station. Border line between Nogales and Guaymas American consular districts in Sonora. |
| Pesqueira | 1,075 | 151 | Point of departure for Horcasitas mining district to the south. |
| Hermosillo | 693 | 175 | Line crosses Sonora River by iron bridge 309 feet long, in three spans. Between Hermosillo and Torres line crosses two branches of Sonora River. (Hermosillo is capital of Sonora. |
| Torres | 538 | 201 | Branch line, Mexican Union Railway Co., 3-foot gauge, to Minas Prietas (12.5 miles), also called La Colorada Mines, from which line was completed in 1918 for distance of 38 miles in direction of old mining district of Ures, 65 miles distant, which was the objective for mining development. Ruling gradient about 1.5 per cent. Rails: 13 miles, 25-pound; 6½ miles, 30-pound; 18¾ miles, 50-pound. Rolling stock (now almost destroyed and worthless): 4 locomotives, 3 passenger coaches, 12 box cars, and 15 flat cars for ore, etc. From Minas Prietas there is a branch line built to El Represo, a mine not now in operation. From Minas Prietas a wagon road starts for San Jose de Pimas, Tecoripa (point for Santa Barbara), San Javier (for the coal fields of Los Bronces), La Barranca, and Toledo, a station on the Tonichi branch—all mining centers, but at present closed down because of existing conditions. From Minas Prietas another wagon road leads to Lapiz, 20 miles to the south, to the Santa Maria graphite mines, now being worked on a small scale. |
| Ortiz | 347 | 235½ | San Marcial coal fields. From Ortiz a wagon road, through mining properties, runs to Cumuripa. (See below.) |
| Empalme | 5 | 260 | Workshops of Southern Pacific Railroad of Mexico. Town of 4,000, owned by the company. Modern equipment. General railway repair and erecting shops. Coal storage of railway; capacity, 10,000 tons (coal used, New Mexico "Gallup" coal). A spur track runs across an arm of a shallow lagoon on an embankment 1 mile long and then follows the shore to Mile 265, to Guaymas, a seaport. From Empalme line continues south to Corral. |

| Towns. | Elevation. | Distance from Nogales. | Description. |
|---|---|---|---|
| | *Feet.* | *Miles.* | |
| Corral | 122 | 323 | Branch line runs northeast along right bank of Rio Yaqui to Tonichi, via Buena Vista, 16½ miles, 194 feet elevation; Cumuripa, 41½ miles, 285 feet; Toledo, 93 miles, 590 feet; and Tonichi, 96 miles, 600 feet. From Tonichi the survey runs along the San Bernardino and Bavispe Rivers to join the line to Nacozari from Douglas. The line beyond Tonichi was under construction as far as the mining camp of Cienegita, 20 miles southeast of Sahuaripa, in 1909. The section from Corral to Navojoa, main line, has a maximum grade of 0.5 per cent and a minimum curve radius of 1,650 feet. South of Corral the line runs southeast in general direction, crossing the Rio Yaqui on a large bridge which has escaped destruction. |
| Navojoa | 125 | 376½ | Here the Rio Mayo is crossed by large steel bridge. Branch line to Alamos, 1,282 feet elevation. Maximum grade, 2.8 per cent; minimum curve radius of branch line, 625 feet. Alamos is a mining center and is the nearest outlet point for the Chinipas (Arteaga) mining district in Chihuahua, about 60 miles distant. A narrow-gauge steam railway connects the Palmarejo mine with the Chinipas River, 20 miles distant. A new branch line is being built now by the Mexican Government to connect Navojoa with the port of Yavaros, approximately 60 miles distant down the Mayo Valley, which is the largest producing section for the chick-pea, or "garbanzo," of the "west-coast" region. The section from Navojoa to Culiacan has a maximum grade of 0.5 per cent and a minimum curve radius of 925 feet. The line crosses a more or less rolling country with numerous rivers and creeks. |
| Masiaca | 167 | 403 | |
| Don | 166 | 429 | Between Don and Francisco the line crosses the Rio Alamos, not an important stream. |
| San Blas | 115 | 460 | Crossing of Fuerte River. River varies from 2 feet in depth by 250 feet in width at extreme low water to 1 mile wide, 25 feet in depth, and a current of 7 to 10 miles per hour during flood season. Junction with Kansas City, Mexico & Orient Railway to Topolobampo. |
| Naranjo | 152 | 491 | Between Naranjo and Toruno line crosses the Ocoroni arroyo. |
| Toruno | 154 | 493 | Between Toruno and Bamoa line crosses the Sinaloa River. |
| Bamoa | 138 | 504 | Principal point for the Ocoroni and Sinaloa River Valleys, where there is considerable new planting of tomatoes, winter vegetables, garbanzos, etc. |
| Capomas | 143 | 513 | Between Capomas and Guamuchil line crosses the Mocorito River. |
| Guamuchil | 139 | 526 | |
| Palos Blancos | 192 | 549 | |
| Retes | 114 | 565 | Point on railway nearest to Pericos, plantation of sugar cane and (principally) "mescal" distillery. |
| Culiacan | 119 | 597 | Line crosses Culiacan River—just below junction of Tamazula and Humaya Rivers—over steel bridge of 14 spans of 70-foot deck-plate girders and 2 spans of 200 feet through Pratt trusses. Branch line: Ferrocarril Occidental, to Altata, 38 miles, down the Culiacan Valley. |
| Quila | 172 | 628 | San Lorenzo River is crossed by bridge of 72 spans of 70-foot deck-plate girders. Between Quila and Mazatlan, line crosses the large rivers Elota and Piaxtla and the smaller Quelite. Branch line to El Dorado (sugar plantation and mill of Redo y Cia.) and small port, distance 14 miles. |
| Mazatlan | 0 | 734 | Seaport. From Mazatlan to the Santiago River the maximum grade is 0.4 per cent and the minimum curve radius 625 feet. Between Mazatlan and Rosario the Rosario River is crossed on a wooden bridge, recently burned out for the sixth or seventh time. |
| Rosario | 55 | 774 | Mining town for the famous "Rosario" mine of Mr. Bradbury, of Los Angeles. |
| Esquinapa | 46 | 789 | Center of the shrimp-fishing industry. |
| Acaponeta | 81 | 828 | Between Acaponeta and Yago the line crosses the San Pedro River, in the valley of which is a new winter tomato and melon growing center. |
| Yago | 89 | 879 | Between Yago and Nanchi the Santiago River is crossed on large steel bridge, six spans of 70-foot steel girders and three 200-foot spans of Pratt trusses. From the Santiago to Tepic the maximum grade is about 2 per cent. The present condition of this line, long out of operation on account of the revolutions and recently put into condition, is very poor. The running time for mixed passenger and freight trains between the port and Tepic is from 16 to 20 hours. Yago is also the point for Santiago Ixquintla, the largest town in the Santiago River Valley, some 14 miles distant from the railway and in the heart of a very rich agricultural section of the great alluvial valley of the river. |
| Nanchi | 106 | 882 | |
| Roseta | 187 | 898 | Between this point and Aguirre there is a rise of 2,062 feet. |
| Aguirre | 2,249 | 917 | Sugar mill and plantation of the Aguirre estate, of Tepic. |

| Towns. | Elevation. | Distance from Nogales. | Description. |
|---|---|---|---|
| | *Feet.* | *Miles.* | |
| Tepic | 3,186 | 931 | Present terminus of the line. The section from Tepic to Guadalajara is not completed. The time allowed for this construction by the Government under the original concession has now lapsed and a new survey is being carried out by the Mexican Government engineers from the end of the Guadalajara-San Marcos Branch to Tepic and from there to the port of San Blas, according to present plans of the Government. The distance between Tepic and the present end of the line out of Orendain, where the Southern Pacific leaves the Mexican National Railways near Guadalajara, is given, according to the Southern Pacific survey, as 91 miles, which includes some 17 miles of bridges and tunnels, with an estimated cost of $11,000,000. |
| La Quemada | 4,268 | 1,022 | |
| Magdalena | 4,461 | ..... | |
| Tequila | 3,997 | ..... | Center of mescal liquor industry. |
| Amatitlan | 4,903 | ..... | There is an elevation of 906 feet between this point and Tequila in 8 miles of track. |
| Quiteria | 4,024 | ..... | Difference of 879 feet in 5 miles of track. |
| Orendain | 4,730 | 1,064 | Change to Guadalajara. The distance from Orendain to La Quemada is given as 68 miles, but the right figure is 42 miles. |

### ANNUAL REPORT FOR 1922.

The annual report of the Southern Pacific Railroad Co. of Mexico as of December 31, 1922, shows the following claims against the Mexican Government up to that date:

| | | |
|---|---|---|
| Total damage from 1910 to December 31, 1921 | | $5,767,630 |
| Equivalent in Mexican pesos | | 11,535,260 |
| Claims against Mexican Government | pesos | 27,875,427 |
| Subvention and unpaid interest | do | 4,964,845 |
| Total claims | do | 32,840,272 |
| Claims already filed | do | 26,268,121 |

The average mileage operated in 1921 was 1,054.7, as against 1,001.47 for 1920. Only such maintenance was carried on as was necessary for operation of trains over lines open to traffic.

The system never paid a profit in excess of operating costs until late in 1921 when, for the first time, tonnage handled paid for line conditioning (on a temporary scale) and operating costs, and this condition continued during 1922.

### NACO-CANANEA LINE.

The line from Naco to Cananea, formerly a part of the Rio Yaqui, Cananea & Pacific Railroad, which was absorbed and consolidated by the Southern Pacific Railroad of Mexico, is an extension of the railway from Douglas, Ariz., forming a part of the El Paso & Southwestern System, and is also connected with Benson. The maximum grade is 2.45 per cent and the minimum curve radius 715 feet. The line is

of standard American gauge. Following are notes concerning the towns on the line:

| Town. | Elevation. | Distance from Naco. | Description. |
|---|---|---|---|
| | *Feet.* | *Miles.* | |
| Naco | 4,607 | 0 | Frontier station. Line runs in a southwestern direction to Cananea. |
| Del Rio | 4,681 | 29 | Junction with line from Nogales. |
| Cananea | 5,270 | 38 | Mines of the Cananea Consolidated Copper Co., which are connected by standard-gauge track with smelters, reduction plants, etc. Mines have recently resumed operations—August, 1922—after being shut down for one and a half years as a result of revolution in Mexico and copper market conditions. Cananea is one of the largest copper camps in the world and produces enormous tonnage of this metal when working with full force. |

### PRESENT STATUS OF SOUTHERN PACIFIC CLAIMS.

The Southern Pacific Co. has made repeated attempts to reach an agreement with the Mexican Government (Obregon régime) for the adjustment and at least partial payment of the claims of the company against the Government for damages to the property, destruction of rolling stock and material, and services rendered in the transportation of troops and supplies during the various revolutions in Mexico, without result to date—the Government alleging lack of sufficient funds to meet these claims at this time, though a large proportion of the claims have been allowed by the various commissions appointed to pass on them in detail. The new president of the Southern Pacific of Mexico has made an offer to the Government—stated as the new policy of his company—to the effect that whatever sums, however small, paid on account by the Government would be immediately expended by the company in the new construction work necessary to connect the line with Guadalajara and the Mexican National Railways at that point, instead of this money being applied on account of past claims for damages, etc. It should be borne in mind that it is very vital to the best economic interests of the entire West Coast region, and also to the central part of the Republic, that direct rail communication be established as soon as possible in order that the West Coast may have a direct, easy, rapid outlet for its surplus food products to the markets of the interior, where these have been badly needed during the past few years in the thickly inhabited part of Mexico.

The Mexican Government, in February, 1922, through the Ministry of Hacienda (Treasury), announced that Mexican Government engineers were to be placed at once at the task of relocating a practical route from San Marcos (Jalisco) to Tepic, and from there to the port of San Blas. In August the chief engineer of the Mexican National Railways, who had completed the survey and location of the new Rio Mayo Railway in southern Sonora, was ordered to proceed to San Marcos, Jalisco, to take charge of this work, and it was later claimed that a better route had been found than the one selected by the Southern Pacific engineers between Tepic and La Quemada, which includes the canyon of the Rio Santiago and some

of the most difficult terrain in the entire country, being very broken in character in this section of more than 90 miles.

It should be recalled further that the time allowance contained in the original Diaz Government concession for the Southern Pacific to Guadalajara from Tepic (the line having been built in sections under a subsidy) has, in the meantime, lapsed on account of the inability of the company to continue this work while the country was torn by warring political factions and desolated by bandits. On account of the general lack of funds in the Mexican Government's Treasury, it is very doubtful whether the Government will be able to proceed with the actual construction of this line. The attitude of the Southern Pacific, in view of the enormous expense involved in the construction of this part of the system as originally planned—some $11,000,000 United States currency—was that they were willing to have the Government construct this connecting link, which would automatically afford the Southern Pacific West Coast Line direct rail communication and provide it with the much-desired and necessary long tonnage haul without the expense of constructing this difficult part of the line.[4a]

### PRESENT COST OF SOUTHERN PACIFIC RAILROAD OF MEXICO.

According to an article appearing in the Bulletin, official organ of the Southern Pacific Co., published in October, 1921, the total cost of the West Coast Line, since 1905, has been about $125,000,000, over and above subsidies paid by the Mexican Government—$44,704,526 having been charged off to profit and loss, due principally to losses sustained by the property in various ways during the periods of revolutionary activity in Mexico. The property in Mexico is valued, in round numbers, at $22,000,000.

### NACOZARI RAILROAD CO.

This line runs 75 miles from the American border at Douglas, Ariz., to Nacozari, the center of a rich copper-mining district where the Phelps-Dodge interests have large properties, as well as several other companies. The property is controlled by the Phelps-Dodge interests, with headquarters in New York City. The line crosses the Mexican border from Douglas to the Mexican town of Agua Prieta.

The maximum grade is 1.5 per cent, and the minimum curve radius is 310 feet. The line is of standard American gauge. The equipment comprises 7 locomotives, 6 coaches, 117 freight cars.

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[4a] In March, 1923, it was announced, through official Mexican Government sources, that a definite arrangement had been reached between the Mexican Government and the Southern Pacific Railroad Co. of Mexico for the reconstruction of the Tonichi Branch, running 96 miles up the Yaqui River Valley from Corral, on the main line south of Guaymas; and also for the reconstruction of the Alamos Branch from Navojoa, on the main line, 38 miles to the town of Alamos. It was stated that the agreement also covers the construction of the extension of the main line from Tepic, in the State of Nayarit, to La Quemada, near Guadalajara. It was also reported that, in all probability, the Tonichi Branch would be extended to connect with the Nacozari Railway (Phelps-Dodge Co.), giving easy access to the United States for this region through Douglas, Ariz.

The Alamos and Tonichi Branches were abandoned in 1912, and it was thought that nearly all bridges, culverts, etc., would have to be replaced and that a number of small tunnels would need to be reconditioned.

In April, 1923, it was reported that active work was in progress on new construction from Tepic and also out from La Quemada, it being hoped to cross the lowlands before the beginning of the rainy season in July.

Following are brief comments on the principal towns touched by this line:

| Towns. | Distance from Agua Prieta. | Description. |
|---|---|---|
| | *Miles.* | |
| Agua Prieta | 0 | Between the border and Mile 20, line crosses three branches of the Agua Prieta River. |
| Fronteras | 33 | From here to Vigia line follows left bank of Rio de Fronteras and crosses three branches of that river. |
| Esqueda | 44 | Rail point for El Tigre Mine and Pilares de Teras, the latter containing the largest deposit of low-grade sulphides of copper in the world. |
| Nacozari | 75 | In center of rich mining district. Rail point for Cumpas region, Moctezuma region, etc. Objective of Tonichi Branch (up Yaqui River) of the Southern Pacific of Mexico from Corral, south of Guaymas. Branch line, 3-foot gauge, private company, to mines of Los Pilares, 7 miles. |

## TONNAGE MOVEMENT AND DEVELOPMENT OF REGION.

In spite of the revolutions (which began before the line reached Tepic), partial crop failures, and frequent interruptions in traffic, the region has continued to progress. In 1920 the total exports from Mexico registered in the Arizona customs district were valued at $31,379,497, with imports into Mexico from the United States valued at $17,004,853.

During the 1920 season 900 carloads of West Coast tomatoes passed through Nogales into the United States from Sinaloa and Nayarit. The 1921 crop was estimated at 3,000 carloads, but only 1,113 resulted because of loss from insect pests, plant disease, and bad handling and packing methods. If the total estimated 1921 yield had materialized it would have meant a shipment to the United States of 2,400,000 "lugs" (crates) of winter tomatoes, or about two and one-half tomatoes for every person in the United States. During 1920 a total of 1,279 carloads of "garbanzos" and 28 cars of minerals were exported to the United States through Nogales, and imports of general merchandise into Mexico through the same port of entry amounted to 1,279 carloads.

The estimated winter-tomato and winter-vegetable acreage for the 1922-23 season is calculated to be at least four times as great as that of the 1921–22 season, although, on account of the danger from frosts, floods, insect pests, and prevalent plant diseases peculiar to the region, the actual yield for shipment is very problematical at this time. The railway is preparing to handle about 3,000 cars of tomatoes, etc., between the Santiago Valley in Nayarit and the Fuerte Valley in northern Sinaloa.

## NEW RAILWAY CONSTRUCTION ON WEST COAST.

### MAYO VALLEY RAILWAY ("FERROCARRIL DEL RIO MAYO").

This new railway, which is being built by the Government of Mexico in conjunction with the landowners of the Mayo Valley (which is the largest area of production of the chick-pea called "garbanzo"), starts at the town of Navojoa on the Southern Pacific of Mexico, near the apex of the Mayo River Valley, 376 miles south of Nogales and 116 miles south of the port of Guaymas (Empalme), and is surveyed to the gulf port of Yavaros, located on the Bay of

Santa Barbara at the mouth of the Mayo River, where a protected but shallow harbor is formed by the alluvial island of Santa Barbara. The annual crop of "garbanzos" has always been shipped by rail to Guaymas and then loaded on steamer for Spain and the West Indies, although recent shipments have been going by rail to New Orleans for export to the West Indies from there by an agent of the Comisión Monetaria of the Mexican Government.

The line follows down the Mayo Valley south of the river, passing through the important agricultural towns of Echacoa, San Pedro, and Huatabampo, the rail distance, as surveyed, being 74 kilometers, or 45.98 miles, approximately. The line is of standard gauge and connects with the Southern Pacific main coast line at the town of Navojoa.

METHOD OF FINANCING AND CONSTRUCTION.

The Mexican Government contracted with the landowners of the valley on a partnership basis—the landowners to do the grading and furnish the ties from the heavy growths of native mesquite that are found along the right of way—the Government to pay the current prices for the work of grading and for the ties furnished on a basis of 33⅓ per cent in cash and 66⅔ per cent in stock in the railway company formed. The estimated cost of the grading was placed at 16 centavos ($0.08) per cubic meter, but the work actually cost more, in spite of the level ground covered by the line, because water had to be hauled considerable distances for the men and stock on the work in the field.

PROGRESS OF WORK.

At the beginning of the rainy season (June, 1922) it was reported that 10 kilometers of line had been graded and steel laid, and one locomotive and a few flat cars were brought in to facilitate the work of construction. By the end of September, 1922, it was reported that only 10 kilometers remained to be graded, the line being in operation to Etchojoa, Kilometer 57, and that the survey of the proposed harbor, docks, etc., was well under way. New rolling stock, including 2 locomotives and 14 box cars, was brought down from the United States, and it was hoped that the line would be ready to move the bulk of the season's "garbanzo" crop, the Government supplying the rails, rolling stock, and operating equipment. The actual work of survey and construction was in charge of the Director General of the National Railways of Mexico and of a personal representative of General Obregon, whose family has large land holdings in the Mayo Valley in the neighborhood of Huatabampo, which is also the name of the Obregon family's hacienda. The Government's grant was originally 150,000 pesos (nominally $75,000 United States currency).

PORT OF YAVAROS.

Surveys of this shallow port and harbor showed that there was 27 feet of water inside the bar off the mouth of the Mayo River at the entrance off Santa Barbara Island, but only 13 feet of water at mean low tide around the island of Viejas, which it is proposed to use as the terminal and wharf site for the new railway. The bar itself has only 12 feet of water at low water and will have to be dredged. The Mayo, like all other rivers of the West Coast, carries an enormous amount

of alluvial material in its waters at flood season, and alluvial formations are always changing near its outlet at the sea.

Late in November, 1922, the President of Mexico, in view of the lack of funds for the completion of this railway and the seaport terminal facilities, requested the mining companies (mostly American) of the Alamos district to send representatives to Mexico City to confer with the Government regarding plans for raising additional funds for the completion of the work, it having been found in the meantime that the dredging of the channel and other port works at Yavaros would prove to be more costly than at first contemplated. The "garbanzo" growers of the Mayo Valley have had several bad years, on account of the inadequate market demand from Spain, low prices, and an estimated damage to the crop in 1922 of 25 per cent of the estimated total yield, and they can not be expected to furnish any great amount of additional funds for this project at this time.

#### EFFECT OF LINE ON OCEAN FREIGHTS AND RAIL COMPETITION.

The completion of the Rio Mayo Railway would give the "garbanzo" growers a much shorter haul to tidewater for their product—46 miles (as compared with 116 miles to Guaymas) or even less—as the line passes right through the cultivated region which extends down to the coast from the railway at Navojoa, through the main part of the valley. In September, 1922, agents of the Mexican Navigation Co. (owned by the Mexican Government), which operates three steamers between Mexican West Coast ports and the Pacific ports of the United States, were in the Yaqui, Mayo, and Sinaloa River Valleys offering reduced freight rates with through bills of lading to shippers of wheat, "garbanzos," and other products from the West Coast to the interior of Mexico via Manzanillo and the National Railways of Mexico, or for export via the Tehuantepec Railway. (See p. 65.)

#### DURANGO-MAZATLAN RAILWAY.

This much-talked-of rail connection for the West Coast port of Mazatlan with the interior across the Sierra Madre Range has been variously surveyed in years past, and in 1919 the Mexican Government resumed construction on the line west of Durango City in the State of Durango, on the eastern side of the range. On account of the lack of funds, the work has been recently discontinued by the Government. An attempt at a location was made in 1919 east from Mazatlan to connect with the line projected from the present end of steel on the eastern side of the abrupt mountains which divide Durango from Sinaloa in this section of the range. Any crossing by a railway of this portion of the Sierra Madres would mean many difficulties of steep elevations and heavy grades. Fairly good pine timber exists in merchantable quantities on the eastern side of the mountains, and the region is potentially rich from a mining standpoint, there being several large camps that have been producing for many years.

The original line was called the Mexican International Railway, which was built by the C. P. Huntington interests from San Antonio Tex., via the border at Eagle Pass, Tex. (Piedras Negras, Coahuila, Mexico), to Durango City, via Torreon, where it connected with the old Mexican Central line between Ciudad Juarez (El Paso) and

Mexico City. The original idea of Mr. Huntington was to connect the southwest of the United States with a Pacific port in Mexico, Mazatlan being the objective. This line was taken over by the Mexican Government under the National Railways of Mexico plan in 1907, the control of the Mexican Central being secured in 1909. A branch line runs north from Durango City to Tepeguanes, tapping a rich pine, timber, wheat, cattle, and mining section. Plans have been made for extensions northwest to Guanecevi and west to the mining town of Topia. Another branch connects Durango City with Zacatecas to the south, via Sombrerete, the main line of the Central again being reached at Zacatecas.

The Mazatlan Branch runs west from Durango and there are now a total of 100 kilometers (1 kilometer = 0.621 mile) completed to a point called Llano Grande, from which place an additional 40 kilometers are graded to a point called El Salto. To reach Mazatlan there remain approximately 265 kilometers to be constructed, about 200 kilometers of which are very heavy mountain construction work through an unproductive country. The cost would be very great, equaling the cost of the heaviest railway construction on the American Continent.

Prior to 1910 an American company owning large mining and timber land interests in Durango spent considerable money in a survey and preliminary location of a proposed line of railway from Durango to Mazatlan, via Topia and Canelas, Chacala, etc.

The ultimate construction of this line to Mazatlan seems to be a question of Mexican Government finances, although the line from Mazatlan to the edge of the high mountains on the Pacific side, where there are several large producing mining camps, would not be a too costly undertaking. Immediate tonnage, however, would not support operation unless the line was connected through with Durango and thence with the interior of the country to the east.

#### SUMMARY OF PROPOSED RAILWAY CONSTRUCTION IN WEST COAST REGION.

Summarizing the proposed railway construction on the "West Coast" and starting in the north, in Sonora, one must mention first the connection with the Nacozari-Douglas line by the Southern Pacific's branch up the Yaqui River Valley from the main Coast Line at Corral, now in operation as far as Tonichi. This extension would develop what has been characterized as one of the most richly mineralized regions in the world. Next comes the connection of the Kansas City, Mexico & Orient Railway across the heavy mountain range between Chihuahua and Topolobampo. Then there is the new Navojoa-Yavaros Mayo River Railway nearing completion and connecting the Southern Pacific West Coast Line with the Gulf of California. After this comes the Durango-Mazatlan extension of the National Railways of Mexico, which also, like the Kansas City, Mexico & Orient Railroad, will have to cross the high range of the Sierra Madres. Most important of all is the extension of the Southern Pacific from Tepic to Guadalajara, which will afford a direct rail outlet for the surplus agricultural products of the West Coast to the markets of the central and most inhabited part of Mexico. Exclusive of the harbor work necessary at the new port of Yavaros at the mouth of the Mayo River, it may be roughly estimated that the total cost of

the three major railway connections with the interior of the country across the range will amount to approximately $54,000,000 United States currency.

### RAILROAD FREIGHT CHARGES.

Railway freight charges are fixed by the Ministry of Communications. (See Tarifas de Fletes, Ministerio de Comunicaciones y Obras Públicas.)

The important point for the consideration of the exporter interested in the development of trade with the West Coast of Mexico is that water rates are cheaper and that all-rail shipments from either San Francisco or Los Angeles to, say, Mazatlan, can not compete with shipments made by steamer from either point, and Mazatlan is now the chief distributing point for the West Coast of Mexico.

### STEAMER LINES AND PORTS.

Steamer service covering all the principal ports of the West Coast of Mexico may be said to be more than adequate at the present time, in view of the amount of available tonnage in and out, there being 10 lines of vessels, large and small, operating on the West Coast and to and from American Pacific coast ports. Following the discontinuance of the old Compañía Naviera del Pacífico (Luis A. Martinez y Cía.) during the first years of revolutionary activity in Mexico, and also during the Great War on account of the scarcity of ocean tonnage, the West Coast suffered from the lack of water transportation to a very great extent, especially as the railway was frequently out of commission as a result of revolutionary activities. Exporters in California went so far as to form small navigation companies to furnish tonnage for the transportation of goods to the West Coast points. The Pacific Mail Steamship Co. has again renewed its service out of San Francisco to Mexican and Central American West Coast ports and to the canal, with three steamers—Mazatlan, Manzanillo, Acapulco, and Salina Cruz being the ports of call in Mexico. Two new companies, one controlled by the Mexican Government, with three steamers, and the other of British origin and control but also under the Mexican flag, are competing for the trade between American Pacific coast ports and the ports of the Mexican west coast as far down as Salina Cruz, and several small companies with one or two smaller vessels compete in the way-port trade out of Guaymas and Mazatlan, covering the Gulf of California, the service now also including water transport in shallow-draft vessels to the mouth of the Colorado River, where motor transport connects with Yuma and the cotton-growing lands of the Mexicali Valley at Calexico (Mexicali). Up to September, 1921, there was only one steamer line operating a freight and passenger service on the West Coast, with two motor vessels in service between West Coast ports and San Pedro (Los Angeles). There are now five lines competing, and rates are one-half of what they were at that time. The present situation is that these vessels usually secure a good tonnage of general merchandise from the United States, but have difficulty in securing a sufficient return cargo tonnage of Mexican exports on account of the fact that the West Coast does not produce much that is exportable at the present time except the "garbanzo" crops of northern Sinaloa and southern Sonora.

### EUROPEAN STEAMSHIP SERVICE.

In August, 1922, the French Compagnie Générale Transatlantique announced that, beginning in October, 1922, a monthly freight service would be inaugurated in connection with the company's Pacific coast service for loading "garbanzos" out of Guaymas for European shipment, a total of 3,000 tons of space being reserved on each monthly steamer for loading at Guaymas of this product of export, the bulk of which goes to Spain, with large shipments also to the West Indies, principally to Cuba and Porto Rico. Shippers were required to reserve their space through the San Francisco (Calif.) agency of the company, making a deposit in advance to hold space reserved and to insure the vessel calling at Guaymas for loading, a minimum total of 3,000 tons being required. The same company also offered to insure cargo at a reasonable ocean-risk rate. Direct delivery, without transshipment, was scheduled for Bilboa, Spain, in 30 days' time. The vessels in this service are the steamships *Arkansas*, *Nevada*, *Iowa*, *Indiana*, all classed A-1 and with a speed of more than 11 knots per hour. Heretofore, shipments of "garbanzos" have been made principally in Spanish steamers specially chartered for the purpose of shipment to Spain of this staple Spanish food product. (See p. 132).

The same French company also sends monthly boats to Mazatlan, Manzanillo, and Salina Cruz, with transshipment service at the Canal, the fleet consisting of five vessels (see list) in connection with its Pacific coast service to the United States.

In this same connection it is also interesting to note that steamer service will soon be inaugurated between American Pacific coast ports, including Los Angeles harbor (San Pedro), and the countries of the east coast of South America, via the canal. This new service of ocean freight will greatly increase the scope of direct markets for American Pacific coast products in Latin America.

### LIST OF COMPANIES SERVING WEST COAST.

The following table gives the names of the steamship and navigation companies serving the West Coast, the names and tonnage of vessels owned or operated, and information regarding the itineraries, frequency of sailings, etc.:

| Name of company. | Nationality of registry. | Names of vessels. | Tonnage. | | Itinerary of service. |
|---|---|---|---|---|---|
| | | | Gross. | Net. | |
| Pacific Mail Steamship. | American | Cuba | 3,169 | 1,862 | San Francisco, Los Angeles, Mazatlan, Manzanillo, Acapulco, Salina Cruz, Central American ports, Panama Canal. |
| | | San Juan | 2,152 | 1,308 | |
| | | Newport | 2,643 | 1,653 | |
| Cía. Naviera de los Estados de Mexico, S. A. | Mexican (British control). | Chihuahua | 1,404 | 849 | San Francisco, Los Angeles, and all Mexican West Coast ports of call; boats alternating, in circle; one steamer weekly at all principal ports. |
| | | Sinaloa | 1,404 | 849 | |
| | | Oaxaca | 1,404 | 849 | |
| | | Colima | 1,404 | 849 | |
| | | Chiapas | 1,404 | 849 | |
| | | Guerrero | 1,404 | 849 | |
| Cía. Naviera Mexicana. | Mexican (Government). | Mexico | 2,568 | 1,662 | San Francisco, Los Angeles, Gulf of California, and West Coast ports; 10-day service at principal ports. |
| | | Washington | 1,669 | 893 | |
| | | Bolivar | 1,669 | 893 | |
| | | Bonita | 571 | ..... | |

| Name of company. | Nationality of registry. | Names of vessels. | Tonnage. | | Itinerary of service. |
|---|---|---|---|---|---|
| | | | Gross. | Net. | |
| Fairhaven Steamship Co. | American | Fairhaven | 1,078 | 767 | San Francisco, Los Angeles, West Coast ports; no regular schedule. |
| Cie. Générale Transatlantique. | French | Saint Joseph | 5,796 | 3,688 | San Francisco, Mazatlan, Manzanillo, Salina Cruz, and Canal; monthly service. |
| | | Mississippi | 6,686 | 4,236 | |
| | | Honduras | 5,922 | 3,763 | |
| | | Montana | [1] 6,000 | [1] 4,000 | |
| | | Texas | [1] 6,000 | [1] 4,000 | |
| Agencia Navaro | Mexican | San Carlos | 74 | 55 | Gulf ports. |
| California-Mexican Navigation Co. | American | Alejandro | [1] 175 | 125 | Los Angeles and Gulf of California ports. |
| Guereña Hnos. | Mexican (schooners). | Lurline | [1] 100 | 75 | Two-masted schooners, engaged in trading and cargo service in Gulf and along coast, serving principally shallow ports of Gulf and Lower California. |
| | | Vallarta | [1] 100 | [1] 75 | |
| | | Maria Cristina | [1] 75 | [1] 50 | |
| | | Josefina | [1] 100 | [1] 75 | |
| | | Estrella | [1] 75 | [1] 50 | |
| José de Soto | Mexican | Belisario | [1] 175 | [1] 125 | Gulf ports, with these and other small sailing craft. |
| | | Dominguez | | | |
| Cía. Naviera del Pacifico (Luis A. Martinez y Cía). | do | Union | [1] 500 | | Old West Coast Co., now discontinued except for steamship Union operating to Lower California ports from Guaymas, which is home port, with offices of company; steamship General Pesqueira is laid up and out of repair at present, lying at Guaymas. |
| | | General Pesqueira. | 2,568 | | |
| El Boleo Mining Co., Santa Rosalia, Lower California. | Mexican (French ownership). | Jim Butler | 345 | | No regular service; boats operate between Guaymas and Santa Rosalia, Lower California, for mining company and its copper smelters at Santa Rosalia. |
| | | Korregan II | [1] 345 | | |

[1] Approximate.

### COMPAÑÍA NAVIERA DE LOS ESTADOS DE MEXICO.

The Compañía Naviera de los Estados de Mexico operates under a special concession from the Mexican Government obtained in 1920, service having been inaugurated on the West Coast of Mexico in October, 1921. The company is a subsidiary of the Clyde Line, of Liverpool, and the fleet of six steamers now in service comprises the remodeled "mystery" ships of the British Admiralty which did such good service against German submarines during the last year of the Great War. Their engines gave them fast cruiser speed when needed. The vessels are very long for their beam and now draw 12 feet of water forward and 16 feet aft at normal load line. One boiler has been taken out, two remaining, and the reciprocating engines have been cut down to a maximum speed of 15 knots, the economical cargo speed now being about 12.5 knots per hour. The ships are not very economical cargo carriers, as their lines are too fine for hold capacity in conformity with their length and draft, the latter being too great for several of the West Coast ports. The maximum cargo capacity is only from 850 to 900 tons dead weight. Fuel oil is burned, the supply being secured at San Francisco and Salina Cruz.

The company being a Mexican company and the ships under the Mexican flag, they can engage in the Mexican coastwise traffic,

handling cargo between coastwise ports, as well as to and from the Pacific ports of the United States. The original head office was located in Los Angeles, Calif., but has been recently changed to San Francisco because of the question of return cargoes, etc. Service has also been extended recently to the Pacific ports of Central America, also provided for in the concession. Since the ships are under Mexican registry, the crews carried are Mexicans, except that reservation is made for British supervision in the engine rooms. Preferential rights are granted for customs treatment in order to facilitate the rapid dispatch of the vessels of the company in and out of port—among other features being that of the right to discharge and load cargo from fore and aft hatches on either side simultaneously, etc. This privilege, applying to either domestic or import or export cargo, is not granted to foreign vessels calling at Mexican ports. The vessels of the company carry the Mexican mails free of charge, post office and navigation inspectors and their employees free, and military personnel at reduced rates. The steamers also carry free of charge, for the Government, an allotment of Mexican merchant-marine cadets for ocean-service training.

The concession is not, however, an exclusive one, and the boats of the Compañía Naviera Mexicana, controlled by the Mexican Government, which also operates steamers on the Atlantic coast of the country, are now competing for West Coast traffic with this line; they run also to American Pacific coast ports, from which points, according to a recent arrangement with the Mexican National Railways and the ministries of communications and finance (Hacienda), the Mexican Government's line can issue direct ocean bills of lading to any interior rail point in Mexico, via the Pacific port of Manzanillo, which is the only one south of Guaymas having rail connection with the interior except the Tehuantepec Isthmus line, which is a transshipment line between the two oceans and over which the interior part of the country south of Mexico City is also reached.

This new feature, together with material freight-rate reductions on cargo covered by interior-ocean bills of lading handled by the Mexican Government's line, gives it a very considerable advantage over both the Mexican States Line and the Pacific Mail Steamship Co., of San Francisco, which, being a foreign company (American), can not handle coastwise tonnage between Mexican ports or issue through bills of lading for interior shipment into Mexico by rail over the lines of the Mexican National Railways.

Another important feature of the concession obtained by the Compañía Naviera de los Estados de Mexico, S. A. (Mexican States Navigation Co.), is a subsidy from the Mexican Government paid on the basis of 0.40 peso per gross register ton per 1,000 miles run on coastwise traffic and 1 peso per gross register ton per 1,000 miles run on high-seas traffic, payment being based on ships' log reports to the Ministry of Communications. (1 peso = $0.50 nominally.)

The Compañía Naviera de los Estados de Mexico can not issue through bills of lading to interior points in Mexico, and its representative is at present negotiating with the Mexican Railways for this privilege in order to be able to compete with the Compañía Naviera Mexicana controlled by the Mexican Government.

The issuance of through bills of lading to interior rail points in Mexico via Manzanillo will greatly assist American Pacific coast exporters in increasing their commercial operations in Mexico, at least in the States of Jalisco, Michoacan, Zacatecas, Chiapas, Oaxaca, etc.; the lower freight rates by water and rail will also enable them to compete with exports from the Atlantic seaboard of the United States and from European ports.

### CALIFORNIA-MEXICAN STEAMSHIP CO.

The California-Mexican Steamship Co. was organized in southern California for the purpose of furnishing means of transportation on the West Coast and to and from American Pacific ports during the period of lack of ocean tonnage on the West Coast. Many of the export firms of Los Angeles took a financial interest in the company, being desirous of securing space and transportation for their export goods to the West Coast. Two motor ships were operated—the *Mazatlan* (wooden hull), of 589 tons gross register, and the *Casco*, of 172 tons gross register—both vessels being now discontinued and the company in liquidation, according to latest reports.

### COMPAÑÍA NAVIERA DEL PACÍFICO.

For many years under the Diaz régime, the Compañía Naviera del Pacífico (Luis A. Martinez y Cia., Guaymas), with Spanish and Mexican capital, operated a fleet of small steamers in the West Coast trade from Guaymas to Salina Cruz—with one steamer to San Diego, Calif.—under exclusive concession from the Mexican Government. The company now operates only one small steamer, the *Union*, of less than 500 tons, between Guaymas and the smaller ports of the Gulf of California. Several of the company's old steamers have been taken over by the Compañía Naviera Mexicana, controlled by the Mexican Government. The largest steamer, the *General Pesqueira*, of 2,568 tons gross register, is now laid up at Guaymas in the inner bay.

### COMPAÑÍA NAVIERA MEXICANA.

The Compañía Naviera Mexicana also has in operation steamers on the Gulf of Mexico and Atlantic ports of the country. There are at present four steamers in operation on the Pacific coast of Mexico, one of which runs to San Francisco and San Pedro (Los Angeles Harbor), touching at all principal Mexican West Coast ports once a month. The other three steamers alternate between the following West Coast ports: Guaymas, Topolobampo, Mazatlan, San Blas (Nayarit), Puerto Vallarte, Manzanillo, Zihuatanejo, Acapulco, Puerto Angel, and Salina Cruz on the trip south; Minizo and the gulf ports of San Jose del Cabo, Mulege, La Paz, Santa Rosalia, and Guaymas on the trip north. The average service schedule for ports visited provides that a ship shall call about every 10 days.

As has been stated, this company, through recent arrangement with the Mexican National Railways and the Ministry of Communications, has announced the issuance of through bills of lading to all Mexican National Railway points from the Pacific ports of the United States via Manzanillo, thus giving it a greater advantage over competing steamship lines and at the same time affording increased facilities to the exporters of the Pacific coast of the United States

for the extension of their commercial operations in Mexico; moreover, reduced rail freights are announced in connection with cargo billed to points in the interior of the country and shipped on vessels of this company.

### CRUX OF OCEAN-TONNAGE SITUATION ON WEST COAST.

The crux of the tonnage situation for the West Coast appears to be the matter of sufficient return tonnage in order that the lines engaged in this traffic may operate at a profit. Coffee and chicle are obtained at Salina Cruz for San Francisco, but the northern part of the West Coast does not, at present, produce a sufficient amount of exportable products to provide cargo for the boats sailing to American Pacific ports. Not enough oil nuts, hardwood timber, or mine products are produced under present conditions to insure sufficient return, or export, cargo for the number of steamers now plying in the West Coast trade.

### JAPANESE STEAMER SERVICE.

One of the large Japanese steamship companies is operating monthly steamers touching at Manzanillo, Salina Cruz, and the Panama Canal.

### VALUE AND DESTINATION OF EXPORTS.

In order to convey some idea of the value and destination of exports from the West Coast of Mexico north of Manzanillo, the following table is given, showing the declared exports to the United States from Mazatlan during the first half of 1922:

| According to carriers. | | | | According to ports of destination. | | | |
|---|---|---|---|---|---|---|---|
| Carriers. | Value of exports. | Value of returned American goods. | Total. | Ports. | Value of exports. | Value of returned American goods. | Total. |
| American vessels.. | $709,516 | $1,971 | $711,487 | Nogales, Ariz..... | $148,571 | $92 | $148,663 |
| Mexican vessels... | 710,995 | 6,512 | 717,507 | San Francisco, Calif. | 1,569,344 | 8,033 | 1,577,377 |
| Norwegian vessels. | 154,601 | ..... | 154,601 | San Pedro, Calif... | 1,513 | ..... | 1,513 |
| Southern Pacific Railway. | 140,610 | 92 | 140,702 | New York, N. Y.. | 4,255 | 450 | 4,705 |
| Wells-Fargo Express. | 7,961 | ..... | 7,961 | | | | |
| Total..... | 1,723,683 | 8,575 | 1,732,258 | Total..... | 1,723,683 | 8,575 | 1,732,258 |

## HARBORS AND DOCKS.

### PORT DUES, TONNAGE DUES, ETC.

A presidential decree, under date of October 14, 1922, modifies all dues to which ships entering Mexican ports were subject. Charges for pilotage, clearance, bills of health, mooring, and for all extraordinary services have been suppressed. Hereafter ships in the foreign trade will pay a charge based on the gross tonnage for entering a Mexican port and the same charge for clearing a Mexican port.

The new decree, which became effective November 18, 1922, establishes four different scales for ships entering or leaving a Mexican port. The first scale is for ships of foreign registry engaged in foreign

trade when they unload merchandise of foreign origin at a Mexican port, or when they load merchandise in a Mexican port destined for a foreign port. In such case the new traffic dues, payable both on entering and on leaving the port, are as follows:

For each 10 tons or fraction thereof, up to 500 gross tons registry, 1 peso.
For each 10 tons or fraction thereof, in excess of 500 tons and up to 1,000 tons, 0.80 peso.
For each 10 tons, in excess of 1,000 tons, up to 5,000 tons, 0.60 peso.
For each 10 tons or fraction thereof, in excess of 5,000 tons, up to 10,000 tons, 0.40 peso.
For each 10 tons or fraction thereof, in excess of 10,000 gross tons, 0.20 peso.

Foreign vessels engaged in coastwise trade—that is, when they handle merchandise between Mexican ports—shall pay, both on entering and on leaving, the following traffic dues:

For each 10 tons or fraction thereof, up to 500 gross tons registry, 0.80 peso.
For each 10 tons or fraction thereof, in excess of 500 tons, up to 1,000 tons, 0.60 peso.
For each 10 tons or fraction thereof, in excess of 1,000 tons, up to 5,000 tons, 0.40 peso.
For each 10 tons or fraction thereof, in excess of 5,000 tons, up to 10,000 tons, 0.20 peso.
For each 10 tons or fraction thereof, in excess of 10,000 tons, 0.20 peso.

Ships of Mexican registry engaged in the coastwise traffic shall pay one-half of the dues payable by foreign ships.

Ships entering or leaving a Mexican port without discharging or loading cargo are understood to visit the port in ballast, and they pay one-half of the dues payable for vessels in the foreign trade when they come from or sail to a foreign port, and one-half of the dues payable for boats engaged in coastwise traffic if they come from or sail to a Mexican port.

Ships making a forced call at Mexican ports, without engaging in commercial operations, Mexican vessels engaged in fishing operations, Mexican ships of not more than 100 tons gross register, and Mexican or foreign warships, or boats engaged in official business for the Mexican Government or any foreign government, are exempt from the payment of all traffic dues.

Boats engaged in harbor service shall pay traffic dues yearly, in advance, at the following rates:

If not more than 10 tons register, exempt.
Of more than 10 tons, for each ton up to 100 tons, 1 peso.
For each ton in excess of 100 tons, 2 pesos.

Every vessel of Mexican registry must be supplied with a navigation license. Licensed boats must pay an annual license fee, in advance, of 80 pesos for boats of less than 40 tons; 100 pesos for boats of more than 40 tons registry and less than 100 tons; and 2 pesos for each 100 tons or fraction thereof in excess of 100 gross tons registry. Boats of less than 40 tons registry, not requiring a navigation license, must pay an annual fee of 20 pesos upon being registered. Both license and navigation registration shall be revalidated each year upon payment of the said fees.

When the tonnage of a ship is measured, a fee must be paid for this operation at the rate of 0.20 peso per gross ton. The measurement must be made by the office of the port authorities, and payment is made at the customhouse. The same dues are payable by vessels in river and lake traffic.

Ships engaged in both foreign and coastwise trade pay only under the foreign-trade schedule. The decree just outlined abrogates all previous regulations that may contain features in opposition to the new decree.

Pleasure yachts pay at the same rate as vessels in ballast.

By virtue of this new decree governing taxes on port and tonnage dues in Mexico vessels now pay a uniform "traffic" tax calculated on the register of the vessel, instead of the many different taxes formerly levied. There has been considerable objection to the new regulation, it being claimed that it increases the rates formerly in force and also covers both arrival and departure of vessels, thereby doubling the expense of a vessel at any one port of call. Where the ship touches three ports in Mexico, the expense is now 525 per cent over the old rates. Also, when the ship arrives and departs in ballast, the expense is 80 per cent in excess of the old charges. When the ship comes in and goes out with cargo, the increase over the total charges by the old rates is 125 per cent, and it can readily be seen that coastwise vessels, on account of the heavy expense involved, will be forced to refuse to carry small cargo lots out of ports.

The following are the old laws annulled by this new decree:

1. Those relative to pilotage, anchorage, and change of anchorage, referred to in the Organic Law for Pilots, of July, 1916.
2. Those relative to "taxes of dispatch" referred to in decree of July 10, 1916, which established the office of captains of ports.
3. Those relative to duties on tonnage and additional tonnage referred to in decree of June 1, 1896.
4. Those relative to sanitary documents and health inspection, established by decree of July, 1894.
5. Decree of January 5, 1857, and decree of July 5 of the same year.
6. Decree of May 17, 1922—and all other regulations opposed to the fulfillment of the new decree.

For a general description of the harbors, see "Coastline" under "Topography."

The following reports give a detailed description of the principal seaports of the West Coast of Mexico from Guaymas to San Blas (Nayarit), including La Paz, Lower California, the data contained having been prepared for the use of masters of vessels, steamship companies, and shippers and their agents. The other ports are small and are usually served by schooners and small power craft. (See Handbook of Mexico, I. D. 1205, prepared by the geographical section, Naval Intelligence Section, British Admiralty—"Pacific coast," pp. 195 to 203, inclusive; also, pp. 209 to 212 for lighthouses, etc.)

### PORT OF GUAYMAS, SONORA.

#### PILOTAGE AND TOWAGE.

The use of pilot is optional with the master of vessel, but payment is compulsory. There is an outer and inner harbor, the latter being shallow, and the use of pilot is advisable if the master of vessel is not familiar with the port. Vessels of foreign registry can not enter the harbor after sunset. Vessels under the Mexican flag can enter and depart at night, but only by special arrangement with the ministry of hacienda. Signal for pilot is made off Cape Haro and pilot comes out from inner harbor.

No heavy tugs are available. There is only one steam tug (60 indicated horsepower) used for handling lighters to and from vessels lying in harbor, and this tug is at present out of operation for lack of repairs. There is also one gas tug (40 brake horsepower) for handling lighters. (See p. 71.) Towage is used only in cases of emergency, and regular rates are not in force. The harbor is not equipped with mooring buoys.

All vessels use own anchors in bay. (For special pilotage regulations, see Reglamento para Pilotes Practicos, a Mexican Government publication.)

HARBOR, ANCHORAGE, AND ACCOMMODATIONS.

The approach to the harbor is fairly accessible, but the only aids to navigation are the light at Point Haro and the channel "turn" buoy at approach to entrance of inner bay. The outer harbor has an area of about 4 square miles and the inner bay at the town about 2 square miles. The inner harbor is entirely protected from the sea by surrounding mountains and hills and presents a fairly regular circular basin. The outer harbor is protected, except for the immediate entrance and from the land side to the east, where the land is low and flat. The prevailing high winds come from the southeast as a rule. Deep-draft vessels lying at anchor in the outer harbor are exposed to winds from the southeast and southwest.

Both harbors are natural harbors (bays)—the outer harbor having an anchorage depth of from 30 to 50 feet at mean low tide and the inner harbor a depth of from 15 to 30 feet on the anchorage ground, where lighters are taken alongside. The holding ground is good, the bottom being very muddy. Vessels anchor from one-fourth to one-half mile off shore in the inner bay, depending upon draft and nature of cargo.

*Tides.*—The maximum rise of the tide is 4 feet, and the average mean fall of the tide 2 feet.

*Buoys.*—The harbor is not equipped with fixed buoys, swinging buoys, or other mooring conveniences. All vessels use own anchors in bay.

*Permissible draft for steamers.*—The outer harbor can be navigated by the largest steamers, but not up to the railway wharf, where there is a depth alongside of only 21 feet at the end of the wharf and 18 feet on the side. It is usual for vessels bringing in coal or lumber to lighter part of their cargo before coming alongside this wharf, which is the only one in the port.

Only vessels of medium and light draft (9 to 16 feet) navigate the inner harbor, although large 8,000-ton vessels can enter and lie over near the hills opposite the town. The prevailing winds are from the northwest and from the southeast. Sudden wind and rain squalls are usual during the rainy season, from the beginning of July until the end of September, and at times the fall equinoctial storms are very severe and cause damage to shipping.

The rainy season lasts from the end of June to about the middle of September of each year. At times, some rain can be expected in October. The total annual average precipitation does not exceed 5.6 inches. The climate may be described as semi-tropical.

*Zone for explosives.*—No definite area is set aside for handling explosives, but the port captain directs where vessels so loaded must lie to discharge into lighters. Regulations in this regard are not strict.

*System of harbor control.*—By port captain under the direction of the Secretaria de Comunicaciones y Obras Publicas, Sección de Puertos y Faros (Ports and Lighthouse Section). The handling of cargo in and out is controlled by the collector of customs, who enforces his authority and control by use of the marine service assigned to the port. A combination revenue cutter and coast-guard vessel is stationed at Guaymas (a 110-foot wooden former United States Navy submarine "chaser," powered with triple-screw eastern standard gasoline motors of 250 brake horsepower each, the maximum speed being 19 knots per hour, if the boat is in good repair).

*Quarantine regulations.*—Same as for all maritime nations. Bills of health are not obligatory. All incoming vessels are inspected by port doctor, and the ship's doctor fills out the usual required questionnaire.

*Measurement or weight tonnage.*—Draft is measured in meters or fractions thereof. Cargo weights are always in metric tons. Tonnage dues are calculated on the registry of the vessel.

*Sick mariners' fund.*—None is collected here.

*Cartage.*—Two-wheeled one-mule carts and also wagons are used to transport merchandise from customs warehouses to railway for shipment into the interior. The charge is 2 pesos ($1 United States currency) per metric ton.

*Vessels landing to take or discharge pilot.*—Pilot can be taken or discharged off Point Haro without any port or tonnage charges.

*Steamers calling to bunker only.*—Only emergency coaling is done here, as the supply is limited and the facilities very poor. (See "Bunkers.")

*Agents' charges for dispatching ships.*—The usual rate in Guaymas is 100 pesos ($50 United States currency), this charge including every detail of taking care of the vessel while in port and proper dispatch upon sailing, including making out all necessary papers, contact with customs, port captain, etc. Clearance is included, but an extra charge of 50 per cent is made for clearance at night.

FIG. 4.—CALLE SERDAN, GUAYMAS.

FIG. 5.—CUSTOMHOUSE, GUAYMAS.

FIG. 6.—VIEW OF MAIN PART OF GUAYMAS, FROM HILL ABOVE RAILWAY WHARF.

FIG. 7.—CALLE BELISARIO DOMINGUEZ, PRINCIPAL BUSINESS STREET IN MAZATLAN.

*Agents' or brokers' commission on freight.*—The usual commission in Guaymas is 2½ per cent, calculated on the amount of the freight charges.

*Bills of health.*—Issued by consul of country of nationality of vessel or by consul of country of port of destination. Charge for this service by American consular officer, $5.

*"Sea protest."*—Consul of country of nationality of vessel required to issue certificate of damage in transit of cargo to master on arrival at port, if required.

*Sealed papers and customhouse visit.*—Masters of vessels entering any Mexican port are required to present the following sealed papers to customs: Manifest of cargo, consular invoices of cargo, list of provisions and stores carried, crew list, passenger list.

*Customs stamps on manifest.*—None required.

*Time allowance for discharge of cargo.*—No special provisions, depends on nature of cargo.

*Harbor master's overtime (port captain).*—50 per cent additional.

*Launch hire.*—For gasoline open launches the customary rate is 4 pesos per hour ($2 United States currency), for 1 to 8 persons.

*Boat hire.*—First shore zone: One passenger one way, 0.50 peso; round trip, 1 peso; baggage per piece, large or small, 0.50 peso.

Second shore zone: One passenger one way, 1 peso; round trip, 2 pesos; baggage per piece, 0.60 peso.

Third shore zone: One passenger one way, 2 pesos; round trip, 4 pesos; baggage per piece, 0.75 peso.

The above rates are for week days, sunrise to sunset; after dark, 50 per cent additional. On Sundays and holidays prices are "conventional"—subject to bargain and agreement.

### WHARVES, PIERS, WAREHOUSES, ETC.

The port of Guaymas has only one pier, or wharf, built by the Southern Pacific Railroad of Mexico for its own service in handling coal, lumber, and other railway material. This pier is in the form of a "wing" or "apron" wooden-pile structure, having vessel accommodation on one end and at one side. The depth of water at mean low water at the end is 21 feet, and at the side, throughout its length of 235 feet, 18 feet of water. There is no covered space, the only warehouses of the port (with the exception of several storerooms in the town belonging to merchants, and the "garbanzo" warehouse) being the two belonging to the customs, through which all goods entering the port have to pass before being released to the importers or agents for shipment into the interior.

*Accommodation for ocean vessels.*—The wharf of the railway, as stated, has a linear length on the side of 235 feet, where one large vessel can lie after its draft has been reduced to not more than 18 feet. One large vessel can lie at the end of this wharf, but only one hatch can be worked at a time with a ship in this position, unless lighters are used on the offside from the pier. This pier is used principally for receiving coal and lumber and for exports of "garbanzos" (chick-peas), which are loaded directly from railway cars in to hold of vessel.

*Storage space for cargo.*—The total gross storage space for general cargo in the covered warehouses of the customs is approximately 12,000 tons. All cargo not taken care of at the railway pier goes by lighter to the customs warehouses.

There are no bonded warehouses at Guaymas.

A plan has been proposed by the Mexican Government to make Guaymas a free port.

### STEVEDORING.

All stevedoring rates are based on the metric ton. There is one lighterage company, Luis A. Martinez y Cía. of Guaymas, which owns 10 large wooden lighters of 75 tons each, gross capacity. The average charge for loading and discharging vessels is 3 pesos per metric ton ($1.50 United States currency). The additional charge for the labor of handling cargo in or out of the vessel's hold ("estiva") amounts to 1.25 pesos ($0.62½ United States currency) per ton.

All work of handling cargo on board vessel is for the account of the vessel. Direct lighterage charges from alongside of vessel to customs are for the account of the freight handled, and according to terms of sale and delivery.

*Labor.*—All labor furnished and available is native Mexican. The men are paid double time for all overtime work and may be said to be unionized. There is at present a plentiful supply of labor in the port of Guaymas. Movement of shipping is at a low ebb, resulting in a surplus of labor all over the State of Sonora.

*Rent of lighters.*—This procedure is not usual, but special arrangement can be made with Luis A. Martinez y Cía. for the use of lighters when needed.

*Cranage and other handling facilities.*—With the exception of the locomotive cranes of the railway wharf, all cargo is handled to and from lighters by ships' tackle. The railway wharf is equipped with one 100-ton-capacity crane for which (with crew) a charge of 100 pesos ($50 United States currency) per day of 10 hours is made. The railway also has several smaller cranes on which the same rate is applied. The railway tariff for use of wharf, cranes, etc., is soon to be changed; new charges are to be created and others modified to some extent.

*Rate of discharge and loading.*—At the railway wharf, bulk or sacked cargo can be loaded at the rate of 5,000 to 6,000 sacks of "garbanzos" per day of 24 hours, each sack weighing approximately 220 pounds.

General merchandise can not be handled by lighters from steamer lying in the harbor as fast as can bulky or sacked cargo at the railway wharf. The rate of handling may be estimated at, roughly, 20 tons per hatch per hour for general merchandise in and out of vessel, depending upon stowage, etc.

### BUNKERS.

There are no coal bunkers in operation in the port of Guaymas. The only available coal supply for steamers is that of the Southern Pacific Railroad of Mexico, which keeps on hand some 4,000 tons surplus for the use of its locomotives serving the West Coast line of railway. The company will furnish coal to vessels only in case of emergency, and it is loaded by lighters to the vessel in the bay. The main supply is held at Empalme, the site of the railway shops, about 6 kilometers from Guaymas. Vessels could take coal directly from railway cars alongside of railway dock at a loading cost of $0.75 to $1 per ton, not including the cost of trimming in bunkers. The rate of loading would be about 280 tons per working day of 10 hours.

*Cost of steam coal.*—Good bituminous Colorado coal can be had for $4.50 to $5 United States currency per ton at the mines, to which is added a cost of $9.38 per ton for freight to Guaymas, plus the local transfer charges to the dock and the loading expenses. At present good Australian steam coal costs $11 per ton in San Francisco, to which an ocean freight charge of $5 has to be added. The average cost of loading into bunkers would be $1 per ton.

*Fuel-oil supply.*—The Compañía de Petroleo del Aguila and the Pierce Oil Co. have fairly large warehouses for refined products in Guaymas but do not handle fuel oil—only gasoline, distillate, kerosene, etc., being kept in stock for shipment into the interior of the State and down the coast near by.

### TRANSSHIPMENT OF GOODS.

Goods for transshipment into the interior are handled at Guaymas and shipped over the Southern Pacific Railroad of Mexico, goods going to Hermosillo (capital of the State of Sonora), Esperanzas (Yaqui Valley), Navojoa (Mayo River Valley), and several other points farther south along the line of the railway and also to the mining towns of Alamos, Fuerte, etc. Guaymas is connected by the Southern Pacific West Coast line with all coast points as far as Tepic, in the State of Nayarit, south of Mazatlan.

*Near-by points reached by steamer.*—North: Colorado River, Mulege, Santa Rosalia (El Boleo Co.'s mines), and La Paz, Lower California. South: Ports of Yavaros, Topolobampo, Altata, Mazatlan, San Blas (Tepic), Manzanillo, Acapulco, Salina Cruz, and points south to Balboa, Canal Zone. At Manzanillo, south of Mazatlan, rail connection is made for points in the central part of Mexico, including Guadalajara and Mexico City.

Only launches go as far north as the mouth of the Colorado River, where overland stages (auto) take passengers and some freight to the Mexicali Valley in the Colorado delta. Mazatlan, Manzanillo, Acapulco, and Salina Cruz are the only other deep-water harbors on the West Coast of Mexico, and vessels of more than 16-foot draft can not enter the others with safety.

### REPAIRS.

With the exception of the railway shops at Empalme, facilities for even ordinary marine steam repairs are limited. The Mexican Government maintains a shipyard at El Varedero, on the outer bay, but the marine railway and other equipment is in poor repair at the present time and the plant can not be recommended as safe even for vessels of light weight. The total length of the marine railway is 650 feet over all, with a draft on sill of 26 feet, the lifting capacity for vessels being placed at 2,000 metric tons. Most vessels engaged in the West Coast traffic go to San Francisco for repairs, painting, etc.

The Compañía Explotadora de Maderas maintains a rather large and efficient machine shop and small foundry of 1-ton capacity in Guaymas proper. The equipment includes a small steam forge hammer. The largest pipe-fitting equipment is of 6-inch diameter, both here and at the railway shops at Empalme. There is no regular tariff of repair costs.

### PROVISIONS.

While provisions are not plentiful, vessels can be freshly provisioned in Guaymas. At least 10 hours' advance notice should be given. Fresh beef is fairly good and plentiful, as well as certain fruits, but canned goods, hams, etc., are expensive on account of the high import duty and the large margin of profit.

### BALLAST.

No regulations are in force regarding discharge of ballast in the harbor. The dumping area would have to be specified by the port captain. Stone for ballast can be secured and loaded from lighters. No steamers take ballast, and sailing vessels are of rare occurrence; so all such provisions would have to be especially made locally, under the best agreement possible. Contracts could be made for serving ballast at so much per ton. (See "Stevedoring.")

### WATER.

Both drinking and steam water comes from the same supply as that for the city of Guaymas and is taken by steamers from tank lighters in the bay, the cost of water delivered alongside being $1 United States currency per cubic meter. Delivery on board is by steamer's own pumps and suction. Two water lighters are available. (This water contains considerable lime and other mineral matter and "scales" boilers.)

### WHOLESALE AND RETAIL DEALERS.

Persons interested in lists of dealers are referred to the World Trade Directory of Mexico, by commodities, compiled by the Commercial Intelligence Division of the Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C. These trade lists are available in the United States through chambers of commerce, district offices of the Bureau of Foreign and Domestic Commerce, and also directly from Washington, upon application.

### STORAGE COMPANIES.

There are no regular storage companies in Guaymas. Certain facilities are afforded by Luis A. Martinez y Cía. and the larger merchants.

### MARINE INDUSTRIES.

There are no fish canneries, ropewalk or cordage factories, milk condensaries, iron or steel manufacturers, sail lofts, or other industries in Guaymas with the exception of those noted herein.

### FREIGHT SUPPLY.

The principal ocean tonnage originating at the port of Guaymas consists of "garbanzo" shipments to Spain, copper from the El Boleo Co. plant and mines at Santa Rosalia, Lower California, and sugar from the plantations at Los Mochis, Sinaloa. The bulk of the sugar and wheat production is moved by rail to the interior of Mexico at the present time.

### STEAMSHIP COMPANIES.

For an account of the steamship service at Guaymas, see the section on "Steamer lines and ports," beginning on page 62.

### GENERAL INFORMATION.

*Port works and improvements.*—Various plans have been put forward from time to time for extensive improvements of the harbor and port of Guaymas, calling for the construction of moles, for dredging, etc., in both the outer and the inner harbors. An American engineer is now on the ground to make the preliminary surveys for

this proposed work, but it is very doubtful whether actual work will be started, at least for some time, on account of the lack of sufficient funds by the central government and the fact that Guaymas has ceased to be a port of first class since the continuation of the railway along the coast to Mazatlan.

The population to-day does not exceed 5,000, among whom there are a few Americans and other foreigners, principally German and French. There is also a rather large Chinese group.

The principal imports are general merchandise from the United States. Guaymas formerly supplied the interior of the State of Sonora as far north as Hermosillo and as far south as the northern part of the State of Sinaloa, but this trade has dwindled in recent years, the American border cities and Mazatlan taking the trade away to a very great extent.

*Customs regulations regarding ships' stores.*—A signed list of ship's provisions and stores on hand must be presented to the customs on arrival. Vessels are patroled by customs guards while in the harbor.

*Crews.*—Crews are obtainable, but only of native Mexicans, and authorities require that the master of vessels shipping Mexican citizens in Guaymas sign an agreement to return the men to the port within a stipulated time, at the expense of the company.

*Packing requirements.*—No special packing requirements obtain. The packing usual for rail and water shipment in the United States is accepted as standard on all classes of ocean freight.

## PORT OF TOPOLOBAMPO, SINALOA.

### PILOTAGE AND TOWAGE.

*Pilotage.*—Pilotage is not compulsory, but advisable, as there is a bar lying offshore, off the entrance and along the coast, and there is a narrow and dangerous channel that must be navigated to reach the inner bay.

*Towage.*—No provisions for towage exist. Sailing vessels, except light schooners, can not enter this port under their own sail. There are no towboats.

*Mooring.*—The harbor is not provided with mooring buoys, and vessels tie up at the wharf to load or discharge cargo.

*Special pilotage provisions and regulations.*—Pilot should be notified by telegraph as to date of arrival of vessel so that he can meet it outside the bar. The captain of the port is the administrative official having jurisdiction over the harbor.

### HARBOR, ANCHORAGE, AND ACCOMMODATIONS.

*Approach to harbor.*—Is not easily accessible and is dangerous. Aids to navigation: Lighthouse, and bar and channel buoys, 10 in outside channel and 7 in entrance channel approaching inner bay.

*Area of harbor.*—One kilometer by ¾ kilometer in front of landing.

*Protection.*—Entirely landlocked; surrounded by high hills on all sides. The one drawback to this otherwise ideal natural harbor is the shifting sandbar lying along the coast off the entrance to the bay.

*Anchorage.*—Minimum depth anchorage ground, at mean low water, 18 fathoms. Holding ground, good, black mud. Vessels anchor just off wharf for customs inspection and then proceed to wharf.

*Tides.*—Maximum rise and fall, 7 to 8 feet.

*Mooring buoys.*—Harbor is not equipped with mooring buoys. Vessels use own ground tackle in harbor, or tie alongside wharf.

*Draft allowance.*—The maximum average depth at the entrance (at bar and channel) is only 18 feet—and that at high water. The deepest draft for a vessel that can safely navigate harbor and entrance is 16 feet aft.

*Prevailing winds.*—Southwest trades.

*Storms.*—Sudden equinoctial storms occur in the fall and spring of the year, those of the fall equinox being the heaviest and doing considerable damage along the coast.

*Seasons.*—Rainy season: July, August, and September. Light rains may be expected during the spring equinox, in February or March, lasting intermittently for about two weeks. The climate is humid and semitropical.

*System of harbor control.*—Under the administration of the port captain.

*Fines levied against ships.*—See "Mexican Government customs regulations" (p. 84), "Sanitary code" (p. 89), etc. At Topolobampo, additional fines may be levied for dumping or taking ballast without permission of the port authorities or from the wrong place.

*Quarantine regulations.*—Bills of health are not obligatory. All incoming vessels are inspected, before tying at wharf, by the port doctor, the ship's doctor filling out the required report.

*Measurement or weight tonnage.*—Draft is measured in meters or fraction thereof. Cargo weight is always in metric tons, gross. Tonnage dues are calculated on the gross registry of the vessel.

*Sick mariners' fund.*—None is collected here.

*Cartage.*—There are no roadways in Topolobampo, and all cargo is handled over the wharf of the railway for the interior.

*Wharf charges.*—The only wharf at the port of Topolobampo is owned by the Kansas City, Mexico & Orient Railway Co. There is a mooring charge of from 1 to 6 pesos for each vessel per day, depending on the size of the vessel using the wharf.

The railway company charges 0.50 peso per metric ton, gross weight, on all cargo handled over this wharf over and above stevedoring costs.

*Customs agents' charges for dispatching vessels.*—Vessels of lines operating on West Coast pay their regular agents the usual percentage on freight charges, etc. Irregular boats pay customary fee of 100 pesos to agent for taking charge of all customs and document work while vessel is in port, including cargo arrangements, although this fee (commission) is graduated by agreement according to the size of the vessel and the nature and volume of the cargo.

*Bills of health.*—See p. 89.

*Sea protest.*—Damage to cargo in transit certified to upon statement of master of vessel before nearest American consular officer—in this case, either Guaymas or Mazatlan. The port of Topolobampo is in the Mazatlan consular district.

*Sealed papers and customs visit.*—See p. 84. Masters of vessels entering all Mexican ports of call are required to present to the customs the following sealed papers: Manifest of cargo, consular invoice of cargo for port, list of provisions and stores carried, crew and passenger lists.

*Customs stamps on manifest.*—None required.

*Time allowance for discharging.*—No special provisions; depends on nature of cargo.

*Harbormaster's overtime (port captain).*—Fifty per cent additional.

*Launch hire.*—Boats and launches charge, as usual rate, 4 pesos ($2 United States currency) per hour, for from one to eight persons carried, or line service, etc. No boat hire for passengers, etc., as steamers land alongside wharf.

### WHARVES, PIERS, AND WAREHOUSES.

There is only one wharf, belonging to the Kansas City, Mexico & Orient Railway Co. and served by this line into the interior. It is 210 feet long and 36 feet wide. At extreme low water the depth alongside is 18 feet (5 meters out, depth is 26 feet). The pier has wooden piling and decking. It is not lighted at night. There is no equipment for heavy lifts.

There are two warehouses. One has a floor space of 280 by 40 feet, and the other 110 by 78 feet. Both are constructed of wood, with corrugated iron roofs. Storage charges are nominal. The gross capacity of the two is 3,000 tons of general cargo.

### STEVEDORING.

Stevedoring charges are based on the metric ton, except for heavy lifts, which are handled by the railway by special agreement.

*Labor costs.*—The established rate is 50 centavos ($0.25 United States currency) per hour on shore (dock) and 1 peso ($0.50 United States currency) per hour in hold of vessel. Double time on Sundays and holidays and at night after 6 p. m.

*Class of labor employed.*—Native Mexican "peon" labor. Sufficient for present needs of port traffic. Not unionized at present.

### BUNKERS.

There are no coal bunkers or oil docks at Topolobampo, the nearest supply being located at Guaymas, where fuel oil for steamers is not available. The only point where fuel oil is available on the West Coast is at Salina Cruz.

### TRANSSHIPMENT OF GOODS.

Cargo is shipped into the interior (West Coast and Fuerte Valley) over the Kansas City, Mexico & Orient Railway, which serves the Fuerte River Valley as far east as the town of Fuerte at the end of the valley and also connects with the Southern Pacific of Mexico for all West Coast points as far south as Tepic and as far north as the American border at Nogales, Ariz.

General cargo is handled directly from steamer's tackle to customs shed and from there to railway cars for shipment.

### REPAIRS.

This port has no shops or other repair facilities. The nearest machine-tool equipment is at the railway shops at San Blas, Sinaloa (where railway crosses Southern Pacific of Mexico). There is no dry dock.

### WATER.

The water supply of the port is brought in on the railway in tank cars and delivered alongside vessel upon application to railway agent. Cost: 0.01 peso per gallon.

### SHIP CHANDLERS' AND ENGINEERS' SUPPLIES.

No stocks kept on hand at this port. See port of Guaymas and port of Mazatlan.

### STEAMSHIP LINES.

The only regular vessels touching at Topolobampo are two steamers of the Compañía Naviera Mexicana, which call twice a month, north and south bound for other West Coast ports in Mexico.

### GENERAL INFORMATION.

*Port improvements.*—When the Kansas City, Mexico & Orient Railway was planned, the idea was to make Topolobampo the Pacific terminus of this new transcontinental, United States-Mexico line, to compete with San Francisco for trans-Pacific shipment and also for shipment through the Panama Canal. The railway has not been completed, and at present no improvements are contemplated.

*Native population.*—Three hundred people.

*Industries.*—Sugar and winter tomato and vegetable production in the Fuerte Valley served by the railway. (See "Agriculture.")

*Principal imports.*—General merchandise from the United States.

*Principal exports.*—Dried shrimp to China, via Guaymas or Mazatlan and San Francisco, Calif. (The sugar production goes by rail to El Paso, Tex., where it is held in storage for distribution into the interior of Mexico, principally.)

*Remarks.*—This is not a military or naval port. There is no radio station and no station from which signals are made to incoming vessels. Mexican standard time is used (that is, Mexico City meridian); no time ball or observatory. The captain of the port is the only official residing at the port.

The sanitation of the town is fair. A small hospital is maintained by the railway company for its employees, with one American doctor in charge. It is advisable to boil drinking water.

The port has no cable communications, wire communication being over the Mexican Government lines, from which messages for foreign points are transferred to either Western Union at Nogales, Ariz., or the All-America Cable Co. at Mexico City. Mail is received and sent by rail every other day.

Steamers drawing 16 feet of water can come in over the bar.

*Storage.*—Ten days free; $0.01 per 100 kilos for first 10 days thereafter; then $0.03 per 100 kilos for each 10 days thereafter until time limit of six months is exhausted, when goods are sold for the account of the railway company, which also owns the warehouses. (See also customs regulations of the Mexican Government governing storage of goods held, etc.)

(The above data on Topolobampo were collected by Assistant Trade Commissioner H. B. MacKenzie when he visited Los Mochis and Topolobampo.)

## PORT OF MAZATLAN, SINALOA.

### LOCATION AND AIDS TO NAVIGATION.

Location: 23° N.; 106° 30′ W.

Creston Island, on west side of harbor entrance: Square white tower 36 feet high, rising from white house, red lantern. Occulting white light 515 feet above high-water mark. Visible 30 miles at sea.

Mazatlan Harbor: Fixed red electric light on end of customs pier on shore.

### PILOTAGE AND TOWAGE.

No pilot is available, and none is necessary, as the port is an open roadstead and no pilot is used, except for small craft wishing to enter the inner shallow bay, when

a local man is employed, by special agreement. Vessels can enter and leave the anchorage after sunset.

*Towage.*—Not used by steamers except in cases of emergency. Only use of tugs is for small sailing vessels entering the shallow inner bay, when gas launches and one small steam tug of about 60 horsepower are available by special arrangement with the Empresa de Lanchas del Pacífico, which has a monopoly of the lighterage of the port. Charges are according to the tonnage of the vessel to be handled, cargo, etc. There is no assessment by the Government on towage.

*Mooring charges.*—No mooring buoys in harbor. All vessels use their own ground tackle.

*Special pilotage regulations.*—See Ley de Prácticos y Código de Farros, Puertos y Marina Mercante, Ministry of Communications and Public Works, Mexico.

### HARBOR, ANCHORAGE, AND ACCOMMODATIONS.

*Approach and entrance.*—Open roadstead, open from sea, with small rocky islands lying just to north. Considered dangerous on account of rocks and sandbars.

*Anchorage.*—Deep-draft vessels anchor from 1½ to 2 miles offshore from the town, where they are protected only from the north. Dangerous in times of storms, which usually come from southwest and southeast.

*Depth of anchorage ground.*—30 to 80 feet, depending on distance from shore. Holding ground is fairly good in sand and mud. Vessels anchor just inside of Creston Island (which breaks swells from sea), for better handling of cargo into and out of lighters lying alongside.

*Tidal data* —Mean rise and fall average, 3 feet. Spring tide maximum average, 6 feet.

*Prevailing winds.*—The southwest trades.

*Seasons of heavy weather.*—During the rainy season, June to October, sudden squalls at times force steamers to put out to sea. The fall equinoctial storms are violent some years and do considerable damage. Storms signals are given 24 hours in advance, from Creston Island.

*Climate.*—Semitropical. Very hot and damp during the summer months. Excellent winter climate.

*Discharging and storing of explosives, etc.*—No separate zone in harbor anchorage ground. Customs warehouse set aside for storage and handling of dynamite, gasoline, etc., which is lightered to inner shallow bay from alongside vessel.

*System of harbor control.*—By captain of the port, cooperating with military and naval authorities.

*Fines levied against ships.*—See page 84.

*Sick mariners' fund.*—None. No marine hospital here.

*Cartage.*—All cargo is landed from lighters at customs wharf and warehouses. Local cartage within the town, 1.50 pesos per metric ton gross weight on ton lots. Freight cartage from customs to railway station, a distance of about 2 miles, and to explosives warehouse, 2.50 pesos per metric ton, gross weight.

*Customs agents' charge for dispatching vessels.*—Customs agents and ship brokers charge 50 pesos for dispatching ships, this service including all details such as manifest, billing, passenger list, etc. They all charge a commission of 5 per cent on cargo they secure at the port for the vessel. All services of agents at night are at double rates.

*Bills of health.*—Issued by the port doctor. Three pesos for all Mexican ports and 5 pesos for all foreign ports. American consul charges $5 for bills of health for foreign vessels to an American port. Both are required. (See Circular No. 13, August 11, 1922, Mexican Health Office.)

*Sea protest (marine note of protest).*—American consular fee, $2 for foreign ships, covering loss or damage to cargo. In Mazatlan loss is usually due to loss of or damage to cargo in loading or discharging from lighters in the open roadstead.

*Sealed papers and customs visit.*—Masters of vessels calling at Mazatlan are required to present to customs officials the following sealed papers: Ship's manifest, sealed consular invoices, crew list, provision and supply list, passenger list.

*Special charges.*—No additional charges are made for entrance without cargo, with passengers, etc.

*Clearance at night.*—All charges, including that of ship brokers, customs, etc. double rates, as above.

*Time allowance for discharging.*—During the dry season of the year: Dawn to 6 p. m. into lighters alongside. Rainy season: Dawn to 3 p. m. into lighters. Local port laws require that all lighters be discharged at customs pier before sundown, especially during the rainy season.

*Overtime charges.*—Customs guards, when employed on vessel, charge for overtime at night and on Sundays and holidays: 3.50 pesos for each guard on duty, this extra charge being paid by the ship to the customs through agents or broker—prior special arrangement and permit being required.

*Tally clerks.*—Furnished by the ship's agent or stevedoring company at 5 pesos per day of 10 hours. Double pay for night, Sundays, and holidays.

*Launch and boat hire.*—$1.50 per trip from shore to vessel lying at anchor in roadstead, or $0.25 per person. If vessel is farther out than the recognized limit, double charge is made.

### WHARVES, PIERS, WAREHOUSES, ETC.

There are no piers for ocean vessels which anchor in the roadstead. The only wharf is that for lighters at the customs warehouses and the boat wharf for landing small boats and launches.

*Storage capacity.*—The total gross capacity of the customs warehouses at pier for lighters is from 3,500 to 5,000 tons of general merchandise, depending upon the nature of the cargo. No charge is made for storage for the first 15 days after goods are landed at customs, after which rate is 0.01 peso per 100 kilos for the first month and 0.02 peso for each succeeding month. Other storage, if necessary, is obtainable in private storerooms of principal merchants. There are no regular storage companies, and rate would be subject to special agreement.

### STEVEDORING.

*Rate basis.*—Either short or ocean-freight tons, according to ocean bill of lading.

*Cost of discharging cargo.*—This depends upon special arrangement and nature of cargo. If the entire cargo is given under contract arrangement, the rate is often 0.50 peso per ton, and 1 peso per ton after 5 p. m. Otherwise rate is double the above. This charge is for handling cargo in the hold of the vessel.

In Mazatlan there is only one lighterage company, and the stevedores have an association.

The ordinary lighterage tariff of the Empresa de Lanchas del Pacífico, S. A., for 1 metric ton outside of the bay is 3.50 pesos. Following are specific merchandise rates:

| | | Pesos. |
|---|---|---|
| Automobiles | small | 15.00 |
| | large | 25.00 |
| Trucks | small | 20.00 |
| | large | 40.00 |
| Acids | per metric ton | 5.00 |
| Baled cotton | do | 4.00 |
| Boxes, knocked down | do | 4.00 |
| Coal or coke: | | |
| Loose | do | 4.00 |
| Sacked | do | 3.75 |
| Dried shrimp | do | 3.75 |
| Wagons | small | 15.00 |
| | large | 25.00 |
| Explosives | per box, to magazine | .40 |
| Cigars and cigarettes | per metric ton | 4.00 |
| Beef hides, dry | each | .05 |
| Brooms | per metric ton | 5.00 |
| Matches | do | 5.00 |
| Cattle, on hoof | per head (minimum) | 10.00 |
| Fiber | per metric ton | 3.75 |
| Corn and beans | do | 3.00 |
| Flour | do | 3.00 |
| Lumber, ordinary | per 1,000 board feet | 4.00 |
| Fodder in bales | per metric ton | 4.00 |
| Pianos and pianolas | each | 15.00 |
| Metal drums, empty | do | .50 |
| Leaf tobacco, in bales | per metric ton | 3.50 |
| Drugs | do | 4.50 |
| Textiles | do | 4.00 |
| Silks | do | 5.00 |

FIG. 8.—THE HEART OF MAZATLAN.

FIG. 9.—CUSTOMHOUSE AT MAZATLAN.

FIG. 10.—BANANA PLANTATION NEAR SAN BLAS, NAYARIT.

For heavy lifts the rates are:

500 to 1,000 kilos: Double the above rates.
1,000 to 1,500 kilos: Double and a half rates.
1,500 to 2,000 kilos: Triple above rates.
2,000 to 2,500 kilos: Quadruple above rates.
2,500 and above: Special arrangement.

Lighterage rates within the "pozo," or harbor—that is, inside of anchorage for deep-draft vessels—are one-half of the above rates.

All work performed outside of working hours, or during Sundays and holidays, will carry a surcharge of 3 pesos per ton, gross weight, outside of the inner harbor, and 50 per cent of the above rates inside.

Water delivered to vessels lying in the roadstead after hours will cost 5 pesos per metric ton, instead of the usual 4 pesos per metric ton, delivered alongside of vessel for ship's pumps.

The stevedoring tariff of the Compañía Mutua de Cargadores (January, 1919) was as follows:

*Import merchandise cargo.*

| | | Pesos. |
|---|---|---|
| Merchandise: | | |
| City warehouse | per metric ton | 3.50 |
| Customs warehouse | do | 2.50 |
| Customs inspection storage warehouse | do | 1.75 |
| Special commodity rates: | | |
| Cattle and live stock, on hoof | each | 3.00 |
| Brick, tile, etc | per 1,000 | 5.00 |
| Explosives, 25 kilos weight limit each piece | each | .10 |
| Lumber, ordinary | per 1,000 board feet | 2.00 |
| Coal and coke, sacked | per metric ton | 1.50 |
| Coal, loose | do | 2.00 |
| Coal, sacked (steam coal) | do | 1.00 |
| Pianos and pianolas | each | 10.00 |
| Vehicles— | | |
| Weighing less than 500 kilos | do | 7.00 |
| Weighing less than 1,000 kilos | do | 10.00 |
| Weighing more than 1,000 kilos—Special rates. | | |
| Machinery— | | |
| Pieces 400 to 500 kilos each | per 1,000 kilos | 2.00 |
| Pieces 501 to 1,000 kilos each | do | 4.00 |
| Pieces over 1,000 kilos—Special arrangement. | | |

*Export cargo.*

| | | |
|---|---|---|
| Hides, dry (beef) | per 1,000 kilos | 1.50 |
| Dyewoods | do | 2.00 |
| Bullion of gold and silver | each bar | .25 |
| Other merchandise for loading out | per ton | 1.50 |

Overtime rates are double the above.

The service includes placing all goods from warehouse to steamer, or from steamer to shore at customs, and then delivery, less cartage to warehouse, including handling for customs inspection, etc. Coastwise-cargo handling rates are about 20 to 25 per cent lower than the above.

All the above prices are in Mexican pesos (1 peso=$0.50 United States currency at par).

All weights given are in metric tons, of 1,000 kilos each (2,205 pounds).

One 2-ton-capacity steam crane is operated and maintained by the stevedores' association at end of customs pier to facilitate handling of freight by them. Special arrangement for heavy lifts, made with foreman of stevedores, who is also head of the association.

*Rate of loading and discharging general cargo.*—From 750 to 1,000 tons of general cargo per day of 10 hours, ship's hold to lighters alongside, to customs warehouse under most favorable weather conditions.

## BUNKERS AND FUEL OIL.

No bunkers or fuel-oil supply in Mazatlan. Nearest fuel supply for steamers is located at either Salina Cruz or American Pacific coast ports.

TRANSSHIPMENT OF GOODS.

Cargo is shipped into the interior up and down the West Coast by rail over the Southern Pacific Railroad of Mexico; also by pack mule into the interior to the east.

Coast points reached by steamer: North—Topolobampo, Yavaros, and Guaymas. South—San Blas (Nayarit), Manzanillo (rail connection for Guadalajara and Mexico City), Acapulco, Salina Cruz. Lower California—La Paz, Santa Rosalia, Mulege, on gulf, and Ensenada on Pacific side of peninsula.

REPAIRS.

Ordinary marine repairs, except dry-docking work, can be made in the shops of the Fundicion de Sinaloa, at Mazatlan, which maintains a complete machine shop and small foundry, etc. Largest pipe brazing size, 36 inches.

There are no dry-docking facilities. The nearest place is San Diego, San Pedro (Long Beach), or San Francisco, Calif.

PROVISIONS.

Supplies of freshly killed beef, fowls, fruit, etc., can be readily obtained on short notice, say 12 hours. Ice is also obtainable. Local merchants carry supplies of canned goods, but prices are high on account of the heavy import duties on these articles. Fresh fish can be obtained in fair quantities. Average prices for supplies of fresh food are higher than in the United States, from which even flour and potatoes are being imported at present, as well as such fruits as apples, oranges, etc.

BALLAST.

Ballast is used only by sailing vessels. Rock ballast can be obtained by special arrangement with the stevedores and lighterage people. Ballast can be dumped only with the permission of the port captain, who would not allow rock ballast to be dumped inshore.

WATER.

See tariff of lighterage company. Cost, $2 per metric ton delivered alongside in tank lighter for ship's own suction hose and pump. Two water boats are available, having a capacity of about 20 tons each. A total of 120 tons can be delivered in eight hours' time alongside vessel lying in the roadstead.

CREWS.

Crews are obtainable, the men being native Mexicans who "sign on" for steamers as oilers, coal passers, fire-room men, steward's department helpers, etc.

CARGOES OBTAINABLE.

Cargo for export is limited to hides, hardwoods, dried shrimp, and some mine products—very limited amounts at present. Coastwise cargoes consist of sugar, wheat, corn, and beans, but these can be carried only on vessels under the Mexican flag.

(For steamship companies and itineraries, see section beginning on p. 62.)

PORT IMPROVEMENTS.

Various plans have been made for the improvement of the port of Mazatlan, to make it into a protected harbor and deep-sea port, but nothing has been done on account of the lack of funds on the part of the Mexican Government. In February, 1922, a contract was made with an American engineer (the same man who carried out the port works of Manzanillo during the Diaz régime) for the construction of a rock causeway from the shore to the outlying island of Creston, thus forming a breakwater for the bay, but this work has not been started as yet.

## PORT OF SAN BLAS, NAYARIT.

LOCATION AND AIDS TO NAVIGATION.

Location: 21° 32′ N.; 105° 19′ W.

Square wooden framework tower above dwelling (both painted white), west of signal station on Vigia Hill.

Flashing white light, 154 feet above high-water line. Visible 18 miles at sea in clear weather.

(Maria Madre Island: Balleto Point; 21° 36′ N.; 106° 33′ W. White stone pillar 13 feet high. Flashing white light, 279 feet above water line. Visible 23 miles. Reported extinguished in 1915.)

### PILOTAGE AND TOWAGE.

Small, partially open roadstead, where vessels lie at anchor off shore at a distance of from ½ to 1 mile, according to draft. Approach is open from the sea, except from the north. No pilot is available, and pilotage is not used. Vessels can enter the anchorage after sunset.

*Towage.*—There are no tugs, and towage is not used. Vessels anchor in roadstead, and all cargo is handled to and from shore on small lighters, from alongside, by man power.

*Mooring charges.*—There are no piers or docks, and steamers use their own ground tackle in the roadstead.

*Special pilotage regulations.*—See Ley de Prácticos y Código de Faros, Puertos y Marina Mercante, Ministry of Communications and Public Works, Mexican Government.

### HARBOR, ANCHORAGE, AND ACCOMMODATIONS.

The approach is easily accessible from the sea, being an open roadstead. The anchorage is good, with silt bottom, but swells from the sea make it rough, and the approach to the town in lighters and small boats is bad on account of the swells over the bar off the mouth of the creek by the town.

*Area of the anchorage.*—About one-quarter square mile. Sufficient for two steamers to swing at anchor at same time and handle cargo in and out by lighters.

*Depth of anchorage and distance offshore.*—Steamers select anchorage just inside of point to the north as best protection from the northwest swells. Depth selected is from 6 to 8 fathoms of chain. According to draft, steamers anchor from ½ to 1 mile offshore. San Blas is a shallow harbor and is used only by small coastwise steamers drawing not more than 16 feet of water, loaded.

*Prevailing winds; storms; weather data.*—The climate is semitropical, with the wet season from the end of June until October. About two weeks of wet weather can be expected about the time of the spring equinox. During the rainy season sudden squalls and rainstorms can usually be expected in the afternoon. The prevailing winds are from the northwest. Bad storms occur at the fall equinox, when the wind comes from the south and southeast.

*Fines levied against ships.*—See page 84.

*Cartage.*—See "Transshipment of goods."

*Customs agents' charges.*—The only steamship agents at San Blas are Delius y Cía., of Tepic (branch office). Charge from 50 to 100 pesos for receiving and dispatching vessels and attending to all customs matters, etc. Usual agent's commission on freight and passengers secured for vessel is 5 per cent of the gross.

*Bills of health.*—Issued by port doctor. (See "Sanitary dues.") Three pesos for all Mexican ports and 5 pesos for foreign ports. American consuls at Mazatlan and Manzanillo, the ports north and south of San Blas, charge $5 for bill of health for foreign vessels to an American port. Both are required. (See p. 89.)

*Sealed papers and customs visit.*—All masters of vessels calling at Mexican ports are required to present to the customs officials on board the following sealed papers: Ship's cargo manifest, sealed consular invoices, crew list, passenger list, and the list of provisions and supplies carried by the vessel.

*Special charges.*—No additional charges are required for entrance without cargo, passengers, etc.

*Clearance at night.*—All charges, including those of ship's broker, customs, etc., are double after sundown.

*Time allowance for discharging cargo.*—During the dry seasom, dawn to 6 p. m. During the rainy season, dawn to 3 p. m. Local laws require that all cargo be discharged by lighters at customs warehouse before dark.

*Overtime charges.*—Customs guards, when employed on vessel, charge for overtime at the rate of 3.50 pesos after 6 p. m. and on Sundays and holidays for each guard on duty, this charge being paid by the ship to the customs. Prior special arrangement and customs permit are necessary to work cargo at night.

*Tally clerks.*—Furnished by the ship's agent and stevedoring company (Delius y Cía.) at 5 pesos per 10-hour day, with double time for overtime.

*Launch and boat hire.*—No power launches are available. Large surf boats with four men are furnished by Delius y Cía. at 4 pesos per round trip, shore to vessel at anchor offshore. Independent boatmen charge 1 peso per person.

### WHARVES, PIERS, WAREHOUSES, ETC.

There are no wharves, piers, or warehouses other than that of the customs and one of Delius y Cía.

*Capacity.*—Customs warehouse can contain from 500 to 600 tons of general cargo. No charge is made for storage of goods in customs until after the expiration of the first 15 days, when the charge is 0.01 peso per 100 kilos of gross weight for the first month and 0.02 peso per 100 kilos thereafter. The total length of time allowed is six months, after which goods are sold for the account of the customs at public auction.

Delius y Cía., of Tepic, maintain offices and a warehouse at San Blas, through which they handle their own products for import and shipment and also those of the merchants of Tepic. (See "Transshipment of goods.")

### STEVEDORING.

Stevedoring depends upon nature of cargo and special arrangement with owners of lighters, Delius y Cía. The total cost of handling 1 ton of freight from hold of steamer to customs warehouse is about 7.50 pesos per metric ton.

*Heavy lifts.*—No cranes or other facilities exist.

*Rate of loading and discharging general cargo.*—About 500 tons can be handled in a day of 10 hours in good weather.

*Lighters.*—The only lighters available are those of Delius y Cía., who maintain six boats of 10-ton capacity each.

### BUNKERS AND FUEL OIL.

None. The nearest coal and oil supply for steamers is at California ports or at Salina Cruz.

### TRANSSHIPMENT OF GOODS.

San Blas is a port of call only for Mexican coastwise steamers, namely, the Compañía Naviera Mexicana and the Compañía Naviera de los Estados de Mexico, both running steamers of small tonnage to California ports and West Coast of Mexico ports.

The port is now used only during the dry season of the year, when goods can be transported to the principal city of Tepic, about 30 miles inland over a dirt road which will not take trucks, transport being by means of oxcarts, mule wagons, and pack mules. During the rainy season goods for Tepic come to Mazatlan by water and are then shipped over the railway to Tepic, through forwarding agents in Mazatlan.

In the dry season tobacco is shipped out of Tepic and Compostela for Guadalajara, via the rail point of San Marcos, by pack mule from Tepic and Compostela. General merchandise also reaches Tepic from the trade center of Guadalajara by this route, the present southern terminus of the Southern Pacific Railroad of Mexico being at Tepic.

### REPAIRS.

No repair facilities exist. See "Port of Mazatlan."

### PROVISIONS.

Fresh beef can be obtained on a day's notice; also small quantities of native fruits, principally bananas.

### BALLAST.

Ballast is not used.

### WATER.

There are no facilities for obtaining water. See "Port of Mazatlan." In an emergency, a ship could furnish containers and have a small supply brought off in lighters. The drinking water should be boiled.

### FREQUENCY OF STEAMSHIP CONNECTIONS.

The only steamers now calling at San Blas are those of the Compañía Naviera Mexicana (Mexican Government line) and the Compañía Naviera de los Estados de Mexico, the port having about one boat every 15 days.

GENERAL INFORMATION.

During the dry season the port ships limited quantities of dried shrimp, cedar logs, coquito oil nuts, bananas, and cattle hides, and also some tobacco, cotton goods, and native-made soap coastwise.

The anchorage is silting up from the creek, the mud deposits being held in the shallow bay by the rocky point on the north. Present plans of the Mexican Government call for the extension of the National Railway from San Marcos, in Jalisco, to Tepic and San Blas, but it may be predicted that with the railway through to the north and to Guadalajara, the port will fall still further into decay, as there is little prospect of an increase in the tonnage of export products under present conditions.

## PORT OF LA PAZ, LOWER CALIFORNIA.

LOCATION AND AIDS TO NAVIGATION.

Point Prieta (La Paz): 24° 13′ N.; 110° 18′ W.

White wooden tower 33 feet high, with dwelling adjoining. Occulting white light 56 feet above water, visible 10 miles.

La Paz: Fixed green light at end of pier in front of town. Fixed red light 32 feet above water on red tubular iron structure on beach near customhouse, visible 6 miles.

PILOTAGE AND TOWAGE.

*Pilotage.*—The use of a pilot is advisable at La Paz, from Point Prieta, as the navigable channel is narrow and not straight and the bay is shallow in many places. Pilots are not used, however, by masters of the vessels already in the West Coast and Lower California coastwise trade.

*Towage.*—No tugs or power boats are available.

*Mooring.*—No mooring buoys in the harbor; steamers use their own ground tackle.

*Moves within the harbor.*—No fee to harbor master, who is port captain, but his permission to shift anchorage is required.

HARBOR, ANCHORAGE, AND ACCOMMODATIONS.

*Approach to harbor.*—Shallow and twisting channel from Point Prieta. Spar and metal buoys mark the channel from lighthouse at Point Prieta to the town and anchorage.

*Area of bay.*—The area is very large in a shallow bay, the limits of which are from the mainland at La Paz across to the island of Espiritu Santo from Mechuda Head above the town.

*Protection.*—Practically landlocked bay.

*Depth of anchorage.*—At low water, 15 feet, in front of town, 350 feet offshore. The tide lift is about 3 feet.

*Prevailing winds; storms; seasons.*—From October 15 to May the prevailing winds are the northwest trades. The rest of the year the winds are southeast, or calms prevail.

Some rain falls in October, as a rule, but the annual precipitation is extremely low, and the country inland from the port is a desert.

The climate may be termed subtropical and very dry and healthful.

Bad storms can be expected in the Gulf of California during the fall equinoctial season as a rule.

*System of harbor control.*—Under direction of port captain.

*Fines levied against ships.*—See page 84.

*Bills of health.*—Issued by the port doctor. (See p. 89.)

*Sealed papers and customs visit.*—As at all other Mexican ports of call, masters of vessels must present to the customs officials the following sealed papers: Consular invoices of cargo for port; cargo manifest; crew and passenger lists; provision and ship's supply lists.

*Clearance at night and on Sundays and holidays.*—There is no prohibition to clearing at night, but the channel out of the bay to the gulf is dangerous then. Customs officials will give papers before closing time in the late afternoon, and a vessel can sail later in the night. Double charge for agents, customs guards, etc., at night.

*Time allowance for discharging.*—No time limitations are imposed.

*Boat hire.*—No power launches are available. Boats plying to and from steamer with passengers and ship's people charge 0.50 peso per person. The use of boats for lines, etc., is according to arrangement made.

### WHARVES, PIERS, WAREHOUSES, ETC.

There is only one wharf or pier (that of the municipality), which is 115 meters long and is used only for lighters and boats, none except the smallest vessels landing alongside, though steamers drawing less than 15 feet of water can tie at the end of this pier.

The only available public storage is that of the customs, where some 600 tons of general cargo can be accommodated.

*Storage rates.*—Customs allow goods imported to lie in warehouse 15 days without charge; then charge 0.01 peso per 100 kilos gross weight for the first month and 0.02 peso per 100 kilos for each month thereafter until time limit of six months is exhausted.

### STEVEDORING.

*Base of rates and charges.*—Weight or measurement ton, as per invoice.

*Cost of discharging cargo.*—For general-merchandise cargo, rate is 3 pesos per ton, weight or measurement, from ship's tackle to customs warehouse. One 15-ton lighter is available at a charge of 2 pesos per ton for handling cargo if vessel does not go alongside pier.

*Rate of handling cargo.*—About 250 tons in and out of vessel per day of 10 hours.

### BUNKERS.

There are no bunkering facilities.

### TRANSSHIPMENT OF GOODS.

La Paz has no railway into the interior, which is very sparsely populated. The principal industries are a large tannery and pearl fishing, with some cattle in the interior.

### REPAIRS.

There are no facilities for repairs.

### WATER.

The water supply is very limited. The cost is 0.25 peso per barrel, delivered in casks on lighter alongside.

### STEAMSHIP SERVICE.

Steamers of the Compañía Naviera Mexicana and the Compañía Naviera de los Estados de Mexico, both under the Mexican flag, have a steamer from San Francisco about every three weeks and a steamer north and south in coastwise service about every 15 days.

San Jose del Cabo, Loreto, Santa Rosalia, Mulege, Guaymas, and Mazatlan are nearby ports reached by steamer from La Paz. All these ports—with the exception of Guaymas and the mining town and port of Santa Rosalia, which has a breakwater—are small open roadsteads.

### GENERAL INFORMATION.

The population is very small and the trade purely local. The principal exports are pearl shell, leather (to the interior of Mexico), dye plant, some ore, and small amounts of dried figs, also shark fins to China, via San Francisco.

The principal imports are foodstuffs and general merchandise from the United States (San Francisco). Corn, beans, lard, etc., are shipped in from the mainland of the West Coast of Mexico.

No port works or other improvements are planned or contemplated.

The United States Government is represented by a consular agent who is under the jurisdiction of the American consul at Mazatlan.

## REVISED MEXICAN CUSTOMS REGULATIONS.

Following are extracts from the Revised Mexican Customs Laws, of 1914, giving the articles that affect masters of vessels, fines, etc., and that make laws uniform for all Mexican ports of call:

ARTICLE 23. The captain of any vessel receiving cargo in foreign countries, to be delivered in one or more ports of the Republic, will be obliged to make a general manifest for each port for such cargo, same to conform with model No. 1, of the present customs laws.

II. Numbers of bills of lading in numerical order, the marks, countermarks, and numbers of the packages; the generic designation of the merchandise in accordance with that declared by the shippers in the bill of lading; the name of the consignee as stated in said bills of lading, or the designation to order if it comes so consigned; the total number of packages in numbers and letters. In manifesting cargoes or lots that come in bulk, this circumstance will be mentioned, expressing besides the class of merchandise and the total weight of same. All the above data should be given with the necessary separation in order to identify each package, care being taken to state clearly the marks, numbers, kind, and contents of packages comprised in each consignment on the manifest.

III. The date on which the document is completed and the signature of the captain, or, in his stead, that of the agent or the consignee of the vessel at the port where the merchandise is loaded. The fact that the manifest is signed by another person representing the captain does not exonerate the latter from the responsibility that may result from the failure to comply with the provisions of the law, considering that he assumes this responsibility from the moment in which he accepts and carries the document issued in the above form.

ART. 24. The captains of vessels consigned to "order," or to persons who are not to be found in the port, or who have no representatives therein, will themselves be considered the consignees of the vessel which they command, provided they do not designate some persons established in or residing at the port who will accept and discharge the duties of such.

If the party named by the captain does not accept the commission, proceedings must be instituted as in the case of renunication of consignee. (See arts. 106 and 115.)

ART. 25. When the captain or agent errs in making the manifest, this may be rectified before being certified by the consul, provided the correction appears the same in all four copies of the manifest.

The customhouse at the port of arrival, on receiving a corrected manifest, will compare this carefully with the copy in its possession and, finding them to agree, will accept the corrected manifest without question.

Corrections made after the consul has certified the manifests will be admitted without imposition of fine, provided the correction does not alter the number of packages, whether in the total number or separate parts comprising same, but if a correction is made affecting this data a fine of not more than 50 pesos will be imposed.

ART. 26. The captain will deliver to the Mexican consul or consular agent residing at the port of lading four copies of the manifest and will receive one duly certified; the captain will take this with him, to be presented to the boarding officer immediately on arrival at the port of destination.

If the cargo of a vessel suffers any variation after the manifest has been legalized by the consul, the captain can present to the said consul, or any other Mexican consular agent, a declaration in quadruplicate, setting forth the facts; the declaration will be admissible, if instead of the captain the agent presents the declaration, provided, however, that the declaration is presented before arrival of the vessel at the first Mexican port of call. The official receiving the declaration will return a copy to those interested, sealed and certified, to be presented to the proper customhouse.

The existence of this certificate and its presentation to the customs will not exempt the captain or consignee from the obligation of making the additions or rectifications mentioned in article 123, but it will merit the remission of the penalty incurred, provided it appears clearly that the manifest was presented before the vessel arrived at a Mexican port.

ART. 29. If, on examination, the customs officers find any of the following errors in the documents presented by the captain on arrival, the fines mentioned herein will be applied.

I. The absolute failure to present a manifest, when the vessel carries cargo, will be punished by a fine not to exceed 500 pesos, and when it arrives in ballast, by a fine not to exceed 100 pesos. * * *

III. The failure to deliver to the boarding officer, immediately upon his call on board, the certified manifest will be penalized by a fine not to exceed 25 pesos.

IV. Failure to present any of the documents referred to in paragraphs II, III, IV, V, and VI of the preceding article will cause a fine not to exceed 50 pesos.

[The documents referred to above are (II) list of samples, (III) passenger list and baggage, (IV) stores list, (V) inflammable list, and (VI) list of packages pertaining to the cargo of another vessel, when same does not appear on the manifest with the necessary notation.]

All fines imposed by the customhouse for the foregoing omissions are subject to approval by the Secretary of the Treasury.

When the documents referred to in paragraphs II, III, IV, V, and VI of article 28 are not presented in proper form, the customhouse will exact that they be replaced by correct forms, not permitting, however, any addition or essential variation in them. When the documents are not replaced in due form the work on the vessel will be discontinued pending the replacing of same.

ART. 30. When the captain presents the manifest legalized by the consul, and the customhouse has not received the corresponding copy, the collector will exact that the freight book, bills of lading, and other necessary documents be shown in order to compare the date of sailing of the vessel with the date given in the customs documents.

If the dates do not correspond to each other, two copies of the manifest must be taken, which will serve in discharging the vessel, and notice of the occurrence must be forwarded to the Directors General of Customs, who will consult with the Secretary of the Treasury as to what action will be taken in the matter.

ART. 33. When a vessel is dispatched from a foreign port for various ports in the Republic without cargo for any, the captain must provide himself with a ballast manifest for the first port he touches.

If the vessel carries merchandise for some port in Mexico and none for others, the ballast manifest is only obligatory for the first port of call—that is, provided there is no cargo for said port.

If the vessel touches at various foreign ports and takes no cargo for Mexican ports at any of them, a ballast manifest will be required only from the last foreign port of call to the first Mexican port of call.

ART. 34. Captains of vessels carrying cargo for various Mexican ports and for other foreign ports will deposit in the customhouse at each Mexican port at which they call the manifest of the other cargoes which they have on board. The collectors of customs en route will certify that the deposit has been effected.

In case the merchandise destined for some foreign port is not covered by manifest, the captain of the vessel will be obliged to make a minute, detailed statement of said goods and will deliver same to customs employees as prescribed in paragraph VII, article 28, with the understanding that if any merchandise is found on board which has not been manifested, the captain will be obliged to discharge same for examination, and will be subjected to the payment of double duties on goods so found.

ART. 36. Manifests certified after the sailing of the vessels carrying the merchandise covered by same can be accepted by the collector of customs, provided the date of the certificate shows clearly that it was issued before the arrival of the vessel at any port of the Republic.

ART. 71. If a manifest or invoice is presented to the consul to be certified, covering merchandise which has already left the port, he will certify same in accordance with article 68 [art. 68 provides that the consul must show the date of sailing and hour when documents are presented to be legalized], giving the date of sailing of the vessel carrying the merchandise.

The collector of customs can admit these documents provided the date of the certificate shows that it was legalized before the merchandise arrived at destination.

ART. 93. The collector of customs can authorize loading or discharging of vessels at night or on holidays, when such permission is requested by the captain or agent of vessels, provided he deems this necessary or convenient.

Regarding night work, the conditions of the port will be taken into consideration in order to ascertain whether there will be any risk to persons or to merchandise, and if the watchers can perform that function efficaciously.

In case a collector considers it advisable to deny such a request, he will telegraph such denial immediately to the Directors of Customs, giving his reasons for such refusal.

In performing night work the following rules must be observed:

I. It will be necessary and indispensable for the captain or consignee of the vessel, or in their stead the company or persons to whom the vessel belongs, to file a bond to the entire satisfaction of the collector of customs, sufficient to cover an infraction of the law or of the special requirements of the customs, which may be committed while said work is being performed, and to relieve the collector of customs from all responsibility that might be incurred by virtue of his granting such permit, but it is understood that the granting of permit by the customhouse or the filing of a bond by the captain, consignee, or owners does not absolve them from the obligations to the owners of the merchandise.

II. In order to obtain permission to perform night work, the captain or consignee will present a petition stating whether the work will continue only until 12 p. m. or after that hour.

In the first case the collector of customs in conjunction with the chief inspector will appoint one set of watchers, and in the second case two sets—one for the hours

up to 12 p. m., and a second for the hours after that time. For this extra work the customs will be indemnified in a sum equal to one day's pay for each man discharging the duties of inspector. The indemnity will be received by the customhouse and will be delivered intact to the different men aforesaid.

In case permission has been requested to work all night, and the work is completed before 12 p. m. or is stopped by order of the interested parties, the collector has the right to collect the indemnity for the men appointed to perform the service of inspectors during the second part of the night, and it will be distributed among them.

III. The captains of vessels will also be obliged to agree to comply with and enforce compliance with the provisions of the customs rules governing the inspection of night work, and such agreement must be embodied in the application for permission to perform night work.

IV. For work authorized on holidays, the customhouse will collect as indemnity for the inspectors engaged in the work a sum equal to the daily wages of each of such inspectors, and the same will be distributed in the prescribed form.

V. No work will be permitted to be performed on national holidays, except in extraordinary cases which make it imperative to discharge immediately in order to save vessel or cargo.

ART. 99. When after the discharging of a vessel, packages are found in excess, which belong to another Mexican port, and the discovery is made too late for them to be reembarked on the same vessel, they may, on request of the consignee of the vessel, be shipped by another vessel, the following regulations being observed:

I. When the customhouse at the port where the merchandise or packages are discharged in error has not in its possession a certificate justifying the discharge of the package, communication must be made with the customhouse at the proper port of destination, to ascertain whether the packages in question figure on the manifest for that port and whether they were "short-landed" there.

II. On receiving an affirmative reply, the packages will be loaded under the supervision of a customs inspector, having been previously corded and sealed, and a certificate will be issued notifying the collector at the port of destination of the shipment.

If the merchandise is of such a nature as not to admit of cording and sealing, the collector will obtain a minute description of same in order that it may be properly identified at the port of destination.

III. The customs at the port of destination will duly acknowledge receipt of the merchandise without loss of time.

IV. The original entry will answer in dispatching such merchandise or, in its stead, a copy thereof.

V. The reloading of excess cargo belonging to a foreign port will also be admitted on presentation to the collector of a proper certificate from the customhouse at the port of destination, showing that the shortage exists there; this certificate must, however, be certified to by the Mexican consul or a consul of a friendly nation.

ART. 101. In case the stores for the use of the vessel are, in the opinion of the collector, in excess of the actual needs of the vessel, he will order them stored in a convenient room, under customs seals, where they can not be obtained without destroying such seal, and said seal will not be removed until the vessel is ready to leave port. If the seal appears to be broken a minute examination will be instituted, and, if any goods are found missing, double duties will be collected on the articles found missing.

If the captain avers that he has no place on board in which to secure the excess stores, they will be discharged at the expense of the captain and placed in a Government storehouse, and will be returned on board when the vessel is ready to sail.

ART. 103. If the captain desires to sell part of his stores he will be permitted to discharge same upon payment of customs duties thereon, having previously made regular customs entry and paid such consular fees as would have been applied on the merchandise had it been a regular importation. The entry for the excess of stores will contain all the data required on entries of regular importations, and will be subject to the same rules.

ART. 106. The consignee of a vessel is the person mentioned as such on the manifest. The captain is authorized to name a consignee when the vessel is consigned to "order," or he may name some person other than the one named on the manifest. The document naming a consignee must be presented in triplicate and have the stamps affixed as provided for by the law. In order to validate the naming of a consignee, or in appointing one in lieu of the one mentioned on the manifest, it will be necessary to state same in writing to the collector before commencing to discharge the vessel, and the person thus named will signify his acceptance at the foot of the document.

ART. 107. The consignee of merchandise is the person mentioned on the bill of lading.

The customhouse will consider the parties named by the captain on the manifest as consignees, when importers fail to present bills of lading for same.

When a bill of lading designates a person as consignee in care of another, the one presenting the bill of lading will be considered the consignee.

Captains, or other persons named by them, will be considered as consignees of merchandise which is landed from a vessel, and which does not appear on the manifest or in the additions thereto, or which is not covered by the bill of lading or consular invoice. The collector, with the consent of the captain, can deliver merchandise to persons proving ownership to the satisfaction of the collector when no bill of lading is presented. The same rule will apply to merchandise covered by a bill of lading which has been erroneously indorsed.

ART. 109. If merchandise arriving by sea is indebted to the carrier thereof for any sum, the captain or the consignee of the vessel can request the customs to refuse delivery of same. The request will be presented in writing, and the customs will refuse delivery of the goods for 15 days. If, in this time, no definite judicial order for retention is received, the merchandise will be delivered in regular form.

The action of the customs will not exempt the customs from payment of storage or guarding, nor will it exonerate the captain from any claim the consignee may have against him.

When the captain is about to depart he must exhibit a judicial order to hold the delivery of the goods or appoint some one to represent him in the premises.

When the consignee claims that the retention will result in loss to his interests the collector may deliver the merchandise upon receiving satisfactory guaranty, in the shape of a bond, that all charges will be paid thereon.

Consignees or captains of vessels have the right to add to or rectify their manifests within 48 hours following the entrance of the vessel, excluding holidays; provided, however, that when the vessel has been charged before the expiration of the above time, the time allowed for additions or rectifications will be two hours after the last of the cargo has been landed, and to that effect the time will be set in the last boat note. No additions will be admitted to rectify the date and signature on manifests.

ART. 124. The additions and rectifications mentioned in the preceding article will be governed by the following rules:

I. Additions which are not of importance and do not affect the number of packages as indicated on the manifest will be admitted without penalty. If the collector finds that there are some data on the manifest that should be rectified he will notify the consignee in order that the necessary correction may be made within 24 hours; failure to comply with the above notice will involve a penalty not to exceed $25.

II. An addition to the manifest that augments the number of packages, provided they are covered by a consular invoice which covers, besides, other packages that appear on the manifest, will also be admitted without penalty.

III. If an addition augments the number of packages on the manifest and the packages so added are not covered by consular invoice, or are covered by a separate invoice, the captain will be penalized in a sum not to exceed 25 pesos per package thus added without affecting the penalties incurred on the merchandise that arrives without a consular invoice.

IV. When a correction is made to the effect that one or more packages are short, owing to their not having been loaded, notwithstanding the fact that they appear on the manifest, it will be admitted without penalty when the packages short are found to appear on a consular invoice with other merchandise found on the manifest; but if the said packages do not appear on a consular invoice or appear on one exclusively for them, the captain will be fined in a sum not to exceed 25 pesos for each package short.

V. Additions or changes in sample manifests will be admitted without penalty.

VI. The customs may reserve their decisions in the matter of the additions referred to in paragraphs II, III, and IV of this article pending investigation to ascertain whether a consular invoice exists and what is its condition.

ART. 125. If, in the discharging of a vessel, there are found to be landed packages in excess that do not appear on the manifest and that have not been added in the time prescribed by article 123, but that are found to appear on a consular invoice with other merchandise which is found on the manifest, the captain will be fined not to exceed $1 for each package in excess, but if the packages are not covered by consular invoice exclusively for them, a fine may be imposed not to exceed $50 without affecting the penalties incurred by the merchandise arriving without consular invoice.

ART. 127. When a captain has not availed himself of the opportunity to rectify his manifest as provided in paragraph IV, article 124, and there are found to be

packages short which appear on the manifest, this circumstance will be noted and no fine will be imposed, provided the merchandise appears on a consular invoice with other merchandise which likewise is found on the manifest, but if the packages are not covered by consular invoice, or are exclusively comprised in one consular invoice, the captain will be fined a sum not to exceed $50 for each package short.

ART. 128. When additions or rectifications made on manifests refer to those made by the captain or agent of vessels before a consul or consular agent in due time or under the prescribed form, as provided for by article 26, no fine will be imposed provided the corresponding certificates covering the declaration are presented to the customhouse by the parties at interest.

Corrections will not be necessary for packages thrown overboard, or otherwise disposed of through dangers of the sea, upon satisfactory proof of the cause being presented to the collector.

ART. 287. Transshipment of the merchandise from one vessel to another at Mexican ports will be governed by the following rules:

I. When a vessel arrives carrying merchandise from a foreign port destined for another Mexican port, or for a foreign port, duly accompanied by the necessary documents, and permission is solicited from the collector of customs to transship same, the collector is authorized to grant said request notwithstanding that the manifests do not state that the merchandise is to be transshipped. If for grave reasons the collector sees fit not to grant the petition, he will communicate the fact immediately to the Director General of Customs for final decision.

II. In case a vessel arrives with merchandise duly destined for the port of arrival, and the consignees of the merchandise desire to have same transshipped to another Mexican port, permission to do so can only be granted by the Secretary of the Treasury. The collector of customs must communicate with the secretary by telegraph, if necessary, at the expense of the consignee.

III. If a vessel arrives in distress and can not continue its voyage, having on board goods destined for other Mexican ports, and the captain or agent applies to the customhouse for permission to transship the cargo, the collector may grant same, subject to the requirements of the maritime law in force, but he must figure directly in the transshipment, discharging, and reloading of cargo.

IV. If by reason of some detention a vessel is obliged to retard its voyage or can not proceed, and if it carries cargo for some other port duly covered by the proper documents, the collector himself (or with previous permission from the judicial authority, if the case has been submitted to court) can dispose the discharge or transshipment of said merchandise.

V. When a captain or the agent requests permission to transfer from the stores of another vessel those that he may require for his own use without payment of duties, such transfer will be permitted if no great inconvenience is experienced by the customs authorities as a result of the transaction.

VI. Always when passengers are obliged to change vessels in order to continue their voyage, transfer of baggage will be permitted.

VII. If the vessel on which the merchandise is to be transshipped has not arrived at the port of transshipment, the collector of customs, on request of the captain or agent of the carrying vessel, may permit the discharge, provided a proper locality or covered lighters are convenient for the safe storage. In this case the goods will remain in care of the customhouse, subject to the payment of storage as provided for in article 275. [Article 275 provides for storage to be collected as follows on merchandise deposited in Government stores: First two months, 1 cent per day for 100 kilos or fraction thereof; third and fourth months, 2 cents per day for 100 kilos or fraction thereof; fifth and sixth months, 3 cents per day for 100 kilos or fraction thereof—on the total weight—from the date on which the last package is stored until the date on which the last package has been withdrawn.]

The moment the transshipping vessel arrives the captain or consignee must present the application for transshipment.

VIII. All transshipping operations will be subject to loading and discharging dues in ports where such dues are established.

## SANITARY CODE.

Following are the regulations of the Mexican Government in regard to American vessels arriving at Mexican ports without Mexican bills of health (translation of articles 16 and 17 of the Sanitary Code):

ARTICLE 16. Bills of health issued in a foreign port are divided into "clean" and "dirty" classes, in accordance with Article 23 of the Sanitary Code. Other bills of

health than those so mentioned, regardless of their denomination, shall be considered as "dirty." The same consideration will be given to a clean bill of health that may have been changed by reason of accident during the voyage and to one issued in a foreign port and not viséed by the Mexican consul at the port of clearance, or at a port near the port of clearance should there not be a Mexican consul there, or by the consul of a friendly nation, as well as a bill of health that may have been altered by corrections or erasures not duly authorized. Vessels not having a bill of health will be treated as having a "dirty" bill of health. The same rule applies to vessels not having a bill of health.

ART. 17. Mexican bills of health are not valid unless obtained at the port of clearance within the 48 hours.

In view of the above, vessels having bills of health that do not comply with the above requirements shall be subject to thorough fumigation.

It will be seen from the above that vessels arriving in Mexican ports from American ports, or from ports where there is no Mexican consular officer, or a consul of a friendly nation who can issue the Mexican bill of health, are considered as having come from a "dirty" port and are subject to fumigation regardless of the fact of the nonexistence of quarantine diseases at the American port of departure.

This works a particular hardship on vessels clearing for Mexican ports from ports where there is no Mexican consular official, as the law requires that all foreign vessels entering a Mexican port must carry a bill of health viséed by a Mexican consular officer.

## PORT WORKS AND IMPROVEMENTS.

With each succeeding new administration in Mexico since 1911 new plans have been presented for large port works and improvements on the gulf and Pacific coasts of the country, and the present administration planned to use the special income tax collected during the Centennial of 1921 for this express purpose. The breakwater at Manzanillo was to be enlarged and extended to give the protected area of the harbor more ocean tonnage space, and other improvements were also planned. Two plans were presented for the very necessary improvement of Mazatlan—one for the dredging of the entrance to the shallow bay back of the town, and the other, on which a contract was finally given in February, 1922, calling for the construction of a stone fill causeway from the shore to Creston Island, thereby forming a breakwater and making the port a protected one. An early decree in 1922 made Guaymas a "free port" (like Hamburg), and the sum of 500,000 pesos (nominally $250,000) was appropriated for the preliminary study of Guaymas and two other proposed "free ports."

In July, 1922, an engineer arrived at Guaymas for the purpose of making the preliminary survey and cost estimate of extensive improvements in connection with the plans of the Secretary of Hacienda (Treasury) to make Guaymas a "free port." The port of Guaymas is now spending about 30,000 pesos in filling in tide-flat lands on the west end of the bay (inner harbor) and plans to use the new land thus created for warehouses, etc. In January, 1922, Guaymas was visited by the Mexican Government commission which had previously recommended that Guaymas, Salina Cruz, and Puerto Mexico be created as "free ports."

It is doubtful, on account of the present condition of the country economically and the state of the Government finances, whether any of the proposed works can be carried out for some time to come. Adequate tonnage is lacking to provide revenue for large expenditures,

and production can not be increased over present quantity under prevailing conditions.

The Guaymas Chamber of Commerce reported unfavorably regarding the plan of the Minister of Hacienda (Sr. de la Huerta) for making Guaymas a "free port," the members considering that local rail freight rates for the concentration of cargo there were too high, as Guaymas would have to draw cargo tonnage from the valleys of the coast to the south and from the mining districts of Sonora.

### NEW PORT OF ST. GEORGE'S BAY.

In August, 1921, it was reported that American engineers, acting for certain Arizona copper-mine interests, were surveying St. George's Bay for a new seaport, with the object of determining the location of a safe and convenient tidewater terminal to serve as the ocean outlet for the products of certain Arizona copper mines. The point selected was at Rocky Point, in the northwest part of St. George's Bay, Gulf of California, about 100 miles north of Guaymas on the mainland. The survey was conducted by the engineers of the Tucson, Gila Bend & New Cornelia Railway Co. Rocky Point is said to hold out many advantages for a deep-water harbor in the way of anchorage, a good beach, protection from storms and currents, and, above all, its nearness to the points of production in Arizona, it being located only about 105 miles south of Ajo, to which place the railway is completed, connecting with the main line of the Southern Pacific in the United States. The extension to St. George's Bay would involve maximum grades of less than 1 per cent. High rail rates on copper products to the eastern markets and for export shipment have induced the Arizona copper companies to seek a deep-water outlet on the Gulf of California, and at Rocky Point it is reported that the construction of a pier 1,000 feet long would afford dockage for vessels up to 15,000 gross tons register. It is thought that the construction of this port would have a beneficial effect on the copper industry of the southwestern part of the United States and in Sonora, Mexico. As yet no concession has been granted by the Mexican Government for this proposed new port.

### SUMMARY OF WEST COAST SHIPPING DEVELOPMENT.

Under the old shipping laws of Mexico a foreign vessel could not handle coastwise cargo between Mexican ports as long as there was a Mexican vessel available to carry it within a reasonable time. During the war, with the resulting scarcity of tonnage, several American vessels found it profitable to operate coastwise on the West Coast, handling not only export and import cargo but also coastwise tonnage offered. With the publication on August 1, 1921, of the new decree which prohibited foreign vessels from engaging in the coastwise traffic, the American vessels were forced to withdraw or take Mexican registry. Following this, a concession was given to the Compañía Naviera de los Estados de Mexico steamship line, which is under the Mexican flag, and the Mexican Government also began to compete in the trade with its Compañía Naviera Mexicana. The West Coast, the Gulf of California, and the peninsula of Lower California now have adequate steamer service, consistent with the amount of tonnage and other traffic that can be offered, and the vessels of the companies now operating in this trade find great difficulty in securing anything like adequate return cargoes, most of the tonnage secured being general

merchandise and foodstuffs imported from the United States, although some cargo is secured for gulf points at Salina Cruz and Manzanillo, originating in Europe or in the interior of Mexico. The greater bulk of the freight carried is import cargo from the United States, as is shown by the totals for the port of Manzanillo for 1918, when 40,889 metric tons were handled, in and out, by that port, of which 35,360 tons were imports, principally destined for the Guadalajara region of the interior, as Mazatlan gets the shipments for points north and south as far as Tepic.

The exclusive features of the new Mexican coastwise trade law give vessels under the Mexican flag an enormous advantage to impose preferential freight rates, although they have to compete with American vessels for export shipments to the United States. As an example: Coffee pays about $12 per ton from Salina Cruz to San Francisco, whereas coastwise boats charge the equivalent of $20 from that port to Mazatlan or Manzanillo for coastwise shipment. The oil refineries of the east coast formerly paid a flat rate of $9 per metric ton for shipments of 500 tons of case-oil products to the West Coast as far north as Guaymas; the present coastwise rate from Salina Cruz is about $21 per metric ton for this commodity in lot shipments.

Salina Cruz has to offer about 1,000 tons a month for export shipment, the principal amount consisting of coffee for San Francisco. Manzanillo has only about 5,000 tons a year for export shipment, all north bound, and Mazatlan, at present, about the same. The tonnage offering at Guaymas is dependent upon the state of the European demand for "garbanzos," which have not been moving freely on account of the market stagnation, successive Government embargoes on exportation of this product, etc.

The export and import statistics accompanying this report give the commodity and tonnage movements of the various ports of the West Coast and show the analysis of the cargo movement.

Tonnage development on the West Coast of Mexico being involved in the economic and industrial development of the region, this subject is treated fully in the later chapters covering the industries of that part of Mexico in greater detail.

Competition has cut rates recently, and the entire West Coast will be benefited by the lower coastwise rates now in force, making water shipment possible for products shipped to the interior of the country where foodstuffs are especially needed.

## ROADS AND HIGHWAYS.

The development of roads and highways has been neglected on the West Coast, although each succeeding administration has made extensive plans for highway construction throughout the territory under discussion. The old stage road ran from the San Marcos terminal of the branch railway out of Guadalajara toward Tepic, and on up the coast to Guaymas, stages operating during the dry season of the year—the vehicles being of the old "Concord" type drawn by the small native mules of the country. The road was seldom worked and was a mere track, often impassable in many places and having no bridges over streams, large or small. Automobiles have since come into general use and are used in the valleys during the dry season and in the towns throughout the year, although good paving is lacking.

The military commander of the West Coast Zone evolved an ambitious plan of highway construction for the coast in 1921, it being planned to construct a paved highway from the American border at Nogales, Sonora, to Tepic, a distance of approximately 800 miles. Ten thousand men were to be put on this work, but funds were lacking. This highway was to be built in sections by communities and States, and a start was made at Mazatlan and Culiacan.

The merchants and farmers fully realize the importance of good roads for their districts and support any such movement, but the country is poor and funds are lacking, as a general rule.

#### NOGALES AND PORT LOBOS HIGHWAY.

This road was projected by Sonora in February, 1922, to run from Nogales, at the border, to Port Lobos on the gulf, 180 miles southwest. This road would afford rapid transportation by motor to the rich district of Altar, the trade of which amounts to about $400,000 (United States currency) per year. The route would pass through the towns of Saric, Tubutama, Altar, Caborca, and several mining points. The aid of the Federal Government was assured for this project, but funds have been lacking.

#### CULIACAN-BADIRAGUATO HIGHWAY.

This road is being built out of Culiacan to the north through a more or less rough foothill country to the interior town of Badiraguato, 72 miles distant. About 7 kilometers of grading had been completed out of Culiacan, capital of the State of Sinaloa, by an American contractor, when the work was suspended by the rainy season in July, 1922. This highway will greatly benefit Culiacan as a trading center, since the country to the north has a considerable production of minerals, cattle, and agricultural products for domestic consumption.

The method of construction followed was that of high dirt fill, rolled in and covered with crushed rock, the specifications being those of a Class B highway in the United States. Two large rivers have to be crossed, as well as numerous small streams which carry large volumes of water in the rainy season but which are fordable during the dry season of the year.

#### MAZATLAN-TEPIC HIGHWAY.

The Mazatlan-Tepic Highway was completed as far as Villa Union, about 20 miles south of Mazatlan, by the end of February, 1922, at a cost of about $3,000 (United States currency) per kilometer. It is planned to extend this highway south to Tepic, touching several very important towns en route and crossing the Santiago River at Santiago Ixquintla, but funds are lacking for the continuation of construction at present. This road has an average width of 30 feet and is built on the macadam system.

In his report on the subject, the American consul at Mazatlan, under date of January 31, 1920, has the following to say regarding road building in the States of Sinaloa and Tepic:

> Good roads are placed as a public utility of first importance in this district because there are none of any importance in the entire length of the two States, and without them there can be no large development of the abundant natural resources.

When it is considered that these two States cover an area of 25,755 square miles, it is apparent that a great deal of road building is necessary.

There is a railway running parallel with the seacoast the full length of this long and narrow district. This road crosses 11 important river valleys, up and down which good highways should be built to facilitate the movement of crops that these valleys are well adapted to produce.

At the very lowest estimate these valleys require an average of 30 miles of good roads each, or about 330 miles for the 11 valleys of this district. Aside from these, at least 1,000 miles of other roads is needed, or a total of 1,330 miles.

Working the matter out on a unit basis I find that good roads can be built in this section at a cost of about $5,000 (United States currency) per mile. It is apparent, therefore, that about $6,650,000 is needed.

If the Federal, State, and municipal authorities would combine in an organized effort to develop good roads, setting aside a certain percentage of the revenue for this purpose, and enacting good-road laws requiring men to contribute five days annually to road work, there is no doubt that the estimated 1,330 miles of highways would be built within two years without outside aid.

At the present time, as always in the past, the mining, ranching, and other people requiring roads have had, for the most part, to build such roads as their private finances would permit.

From Villa Union, a dirt road has been open as far as the rich mining camp of Panuco, about 60 miles inland from Villa Union, which is about 20 miles from the port. This road can be used by automobiles during the rainy season, but only in the dry season for heavy truck-transport operations.

## AGRICULTURE.

### PAST AND PRESENT POSITION OF INDUSTRY.

During Spanish colonial times mining was the primary industry, with stock raising of secondary development, followed by the gradual increase in agricultural production. To-day agriculture has become of primary importance throughout the West Coast, except in the northern and more arid portion of the State of Sonora, where mining is still and will continue to be paramount, because this State possesses what have been characterized in the past as several of the best mineralized regions in the world.

Manufacturing has not developed to any extent, the greatest progress having been made in shoemaking for the local domestic supply. The textile industry is still small and dependent upon other sources of cotton for the few small plants now in existence on the West Coast. Local cigarette factories take care of the demand for the cheaper grades of cigarette peculiar to the region.

The development of industry on the West Coast is inherently involved in the problems of Mexico as a whole, and it is recognized by the people of the region themselves that immigration is a necessary factor, together with the development of some product, or products, of export to such markets as that of the United States. In other words, further development is dependent upon stable conditions in the country, the solution of Mexico's political and social problems, and the creation of new communities by means of immigration. The development of the West Coast is very much like that of the Pacific coast States of the United States; only in the case of Mexico the increase in population will have to come from outside the country, and there is thus injected the problem of conflicting nationalities and racial characteristics.

For years the West Coast of Mexico has been the principal source of supply of the "garbanzo" (chick pea) to Spain and the West Indies, and it also shipped last season a total of 1,113 carloads of winter tomatoes to the markets of the United States, the acreage planted for the 1922–23 season being four times that of the preceding year, with increasing interest and investment in this product of export. The real wealth of the West Coast lies in the 15 river valleys where rich soil is found and where there is sufficient water supply for the irrigation of all available acreage. The very successful development of agriculture and horticulture in California increased the interest on the part of Americans in the development of the river valleys of the West Coast of Mexico—an interest which was brought to a climax by the construction of the line of the Southern Pacific Railroad down the coast in 1908 and 1909—with Mexican capital and energy taking their part in the development of sugar, "garbanzos," and wheat. On account of market limitations and unfavorable legislation affecting ownership by foreigners of land, this development—

with the exception of the winter tomato and vegetable industry, which is relatively new—has now reached its limit. Population is lacking, and further progress means the building up of agricultural colonies by people from the outside and the expenditure of enormous sums in the development and the application of water for irrigation in the river valleys. Last year the Yaqui Valley in Sonora produced a surplus rice crop; "garbanzos" have been stagnant for three years; and this year Sonora also produced a surplus wheat crop over and above the West Coast flour needs in competition with American imported flour.

The need for an exportable commodity is seen in the tremendous interest and investment in winter tomatoes and vegetables for the American market, which affords a ready sale and quick cash payment for these articles. They do not compete with either the Florida or the California production, as they come on the market earlier by some two months and can not compete after the American-grown supply is ready for shipment to the market centers of the country. It is a well-known fact that the West Coast of Mexico could produce citrus fruits at one-half the cost of their production in California, climatic and soil conditions being more nearly ideal than in California, but in view of the inability to export these products to the markets of the United States on account of the tariff protection of the American industry and the lack of the technical and practical knowledge of this highly specialized field, nothing can be done (at least for the present) except to increase the supply for local domestic consumption, which is rather small.

The territory of the West Coast contains 154,000 square miles, reaching from the American border to the southern boundary of the State of Nayarit and being divided from the rest of Mexico by the summit line of the Sierra Madre Range. A large proportion of this area is eliminated from any agricultural development by topographical conditions, and the greater part of the coastal plain is bench land that has no water for irrigation, the only suitable soils lying in the river valleys and deltas. Hardly one-tenth of the total area could be cultivated under any circumstances, and only one-tenth of the portion mentioned has conditions that make it right for intensive cultivation. When considering the West Coast of Mexico from an agricultural point of view, one must think in terms of the several river valleys and not of large expanses of level farming land of uniform character like that found in the American States of Kansas, Iowa, Illinois, etc. The conditions and aspects are very much like those of California, where there is also a series of large valleys, though on the Mexican West Coast the river valleys run from east to west right down to the sea.

On account of the varying nature of the climate, soil conditions, transportation, etc., a separate and detailed description of each river valley will be given, because it is the "valley" that counts and not the West Coast as a whole.

## HYDROGRAPHIC DESCRIPTION OF WEST COAST.[5]

### COMPARISON WITH CALIFORNIA.

In view of very similar conditions of climate, soil, irrigation, etc., the growth and development of California indicate the prospects for the Mexican West Coast. Up to the year 1850 California was stagnant, with a total population of 92,600. Since that time, and more particularly since the completion of the Union Pacific and Central Pacific Railways, the State has attracted a larger agricultural population than any other State of the American Union, its greatest growth having taken place between 1870 and 1890. It had originally the same disadvantages as Mexico. The serious handicaps of most countries where the land holdings continue to be held in very large units are illustrated by the Census report for 1900, which shows that the average size of farms in California was 397.4 acres, producing an annual average of $25.38 per acre, as against the average income of $2.20 per acre from the 4,753 farms in the State that contained more than 1,000 acres each. The good agricultural lands of the Mexican West Coast are, as a general rule, still held under the old Spanish Crown grants in enormous tracts, although a number of these tracts have passed into the hands of American purchasers who planned to cut them up into small allotments and sell them on easy terms to farmers from the United States after water had been developed for irrigation, following the same plan that has been so successful in California, not only from the standpoint of an excellent investment for capital but also from that of the small farmer and from the public and economic point of view.

This development had begun to proceed very rapidly with the completion of the Southern Pacific West Coast Line of railway, and has only been thwarted by the last 11 years of internal strife in Mexico and latterly by adverse legislation on the part of the Mexican Government (Constitution of 1917) which prohibits foreigners from owning land in the country, except under certain conditions.

The State of California possesses approximately the same surface area as the region of the West Coast of Mexico, California having 155,980 square miles, as compared with about 154,000 square miles for the West Coast. In California 12 per cent of the total area is more or less under thorough cultivation, aided by irrigation. Southern California, with its wonderful production of citrus fruits, vegetables, nuts, dried fruits, canned fruits, dairy products, olives, dates, etc., has an area of only slightly more than 200,000 acres in use, exclusive of the Imperial Valley.

In the matter of climate, topography, native races, penetration, etc., the history of the West Coast of Mexico presents almost an exact parallel to that of California. It can be only a question of time until it becomes self-evident that the development of this new field will proceed along the same lines and reach the same final prominence. The greatest interest in the development of the West Coast is being taken by the very people who developed California.

[5] The following account has been taken from the report of Frank H. Olmstead, hydrographic engineer, who reported on the West Coast for the Southern Pacific Railroad Co. of Mexico in 1909—with additions and corrections by P L. Bell, from personal acquaintance and observation during six years' continuous residence on the West Coast of Mexico, while engaged in mining, agriculture, and stock raising. Data have been brought down to Oct. 1, 1922, from field work on the coast during July, August, and September, 1922.

The population of the Republic of Mexico was estimated at 15,000,000 in 1910, giving 19.55 persons per square mile. In 1876 there were 9,380,439 people. Imports into Mexico during the 10-year period ended in 1910 increased from $21,490,604 to $146,376,587. Mexico was getting into line with the rest of the world and was an increasingly important factor to be reckoned with in commerce. In 1906 and 1907 Mexico sent 71 per cent of its exports to the United States, and this ratio has steadily increased since then.

Mexico itself is 1,900 miles long by 750 miles wide, while the territory of the West Coast is 1,200 miles long by 130 miles wide, on an average. The proportion of arable lands in this territory is hardly more than 5 per cent, but this 5 per cent of the total surface area comprises some of the potentially most fertile lands, which, if easy access to the sea is provided by a lateral line of rail transportation, possess many advantages.

When the Panama Canal was opened to traffic in 1915, the West Coast of Mexico, together with the Pacific coast of the United States, should have received its share of the impetus given to development and commerce, but, unfortunately, revolution and unstable conditions in the country have precluded the realization of the full advantage of the benefits that should have accrued. The growth of trade that is logical proceeds by leaps and bounds when it starts right, and the West Coast had every reason to expect its share with the completion of the coast-line railway and the canal.

The world's supply of available and suitable arable lands is being so rapidly absorbed that 10 years more will see the finish in North America. When the Southern Pacific was building down the West Coast in 1908 and 1909 a rush for land was started which was only stopped by revolutions and subsequent conditions in Mexico. Development was presaged which would have rivaled the settlement and development of southern California.

### FUNDAMENTAL CONSIDERATIONS.

The difference in race and national characteristics, the necessity of going into a foreign country where at present legislation is unfavorable to the ownership of the land by foreigners, and general conditions growing out of the various revolutions in Mexico during the past 10 years have stopped this development of the valleys of the West Coast by people from the United States. The problem is a fundamental one, and the ultimate solution can be found only in the slow education of the masses in Mexico itself, or in the recognition of the necessity for a more liberal policy toward foreigners (Americans) in order to bring about the more rapid development of this territory. As an example, the experience of the Argentine Republic may be cited: Argentina had in 1883 about 500,000 acres in wheat; in 1906 it had 14,000,000 acres in wheat; and the ratio has steadily increased, stimulation of production by the native element being fostered by the example of immigration and capital from the outside.

### PRIMARY ADVANTAGES OF WEST COAST IRRIGABLE AREAS.

The great advantage possessed by the irrigable river valleys of the West Coast of Mexico over other regions and agricultural districts is that the rivers in flood season carry large amounts of silt, and that,

at the same time, other previously fine producing areas are dropping off in their annual production on account of soil depletion, while on the lands of the West Coast the opposite is true because soil improvement goes on as cultivation by irrigation progresses.

The Panama Canal has greatly shortened the distance, so that shipments of sugar, oranges, rice, beans, fiber, etc., can compete with those from California in eastern United States and European markets. (California is now shipping citrus products by water through the Canal to the eastern seaboard of the United States in order to be able to compete successfully with the shorter rail haul of Florida to the great centers of population in the United States and also with the cheaper cost of production in Italy—principally as regards lemons.) The distance from the West Coast port of Mazatlan to the Canal is 1,810 miles, and from Colon to New York, 1,989 miles. The West Coast has also a number of fairly good harbors—Guaymas, Topolobampo, Mazatlan, San Blas, and Manzanillo. Topolobampo is a fine natural fjord harbor, and the settlers in the Fuerte Valley will some day possess the great additional advantage of both rail and water transportation to all markets.

### STATE OF SONORA.

#### AREA AND POPULATION.

Next in area to Chihuahua, the largest of Mexican States, Sonora has a surface area of 76,900 square miles.

The population in 1895 was 191,281, and in 1900, 220,553, a gain of 3 per cent per year. The last census figures, those of 1921, give the State a population of 267,474.

The State has 350 miles of ocean frontage on the Gulf of California and two fairly good natural harbors, Guaymas and St. George's Bay (farther north), the latter undeveloped and having no improvements.

#### CLIMATIC CONDITIONS.

The average annual rainfall for the State as a whole is 11.3 inches, these figures being taken at the capital, Hermosillo. The highest record was 19.9 inches and the lowest 5.84 inches. The rainy months are July, August, and September, during which period the average is 8.12 inches. The highest average for any year's rainy season is 12.64 inches, and the lowest rainy season average 4.85 inches. The winter rainfall is 3.24 inches, varying from 0.32 inch, and it is not to be depended upon. Light rains may be expected during the season of the spring equinox. The rainfall in the northern and eastern part of the State is heavier than in the central district of Hermosillo, diminishing toward the gulf and the delta of the Colorado River toward the northwest.

The maximum summer temperature at Hermosillo is 115° F., and the minimum temperature is 34° F., occurring in December.

#### DRAINAGE SYSTEM.

The State is traversed, in a direction approximately northeast to southwest, by four large drainage systems—the Magdalena, Sonora, Yaqui, and Mayo Rivers, which, with their numerous tributaries, have running water the entire year, except in the lower reaches of the first two named, their waters disappearing in the desert wastes, near

the end of their courses toward the gulf, during the dry season of the year.

There is known to exist an artesian belt, the limits of which have not been determined but which starts about 40 miles north of Hermosillo along the line of the railway. There are other districts where the formation is not unfavorable to artesian water development, but these have not been prospected by drilling as yet. Some small interior valleys show excellent and abundant well water at depths of 20 feet or even less.

### YAQUI RIVER ALLUVIAL AREA.

The Yaqui is the largest river of Sonora. Its course is of approximately 680 kilometers (422.5 miles), its source being in the State of Chihuahua near the town of Ciudad Guerrero, where it is known by the name of Rio Papigochic. It is joined in Chihuahua by the Rio Gavilana and enters the State of Sonora under the name of the Rio Aros. In Sonora it receives the waters of the rivers Mulatos, Satachic, and Nacori, which rise in the district of Sahuaripa, and, later, those of the Rio Bavispe, which crosses the district of Moctezuma. Near San Mateo it is also joined by the Rio Sahuaripa and afterwards by the Rio Moctezuma and Rio Chico and by several other small streams nearer the delta, which is navigable for shallow-draft boats for 60 kilometers above its mouth at Algodones Bay.

*Watershed, delta, and irrigable areas.*—The watershed area of the Yaqui is estimated at about 26,000 square miles, of which 500,000 acres are river-bottom lands, of which, in turn, 75,000 are irrigable without storage, the stream having a capacity of 850,000 acre-feet of storage water.

Lying between the Estero Mapola, just south of Guaymas, and the Yaqui River there is found an area of choice cultivated land totaling 12,000 acres situated between the hills and the sea along the Rio Muerto, an old outlet channel of the Yaqui.

A narrow belt of low salt lands runs along the coast from Guaymas to Agiabampo. The plain from Guaymas to the Rio Yaqui covers 130 square miles, but the only good agricultural lands are those at Belem on the Rio Muerto. The salt belt totals 363 square miles between Lobos Bay and Agiabampo, south of the mouth of the Mayo River and at the boundary with the State of Sinaloa.

The choice alluvial lands of the Yaqui delta begin at Esperanza and Cocorit (on the railway) and extend in a fan-shaped delta south of the river to a line running inland from Tobari Bay, the total area of the level delta alluvial fill being, roughly, 1,685 square miles, of which 540 square miles are choice lands lying immediately south of the river and 1,145 square miles are situated still farther to the south and toward the gulf. The Rio Yaqui Canal of the Richardson Bros. Construction Co. takes water from the river at a point above Esperanza and carries the main supply toward the coast across the extreme southern area of the delta proper.

Between the railway and the river lie the lands of the Yaqui Indian pueblos, reaching from Torin to Cocorit, recently returned to the Yaqui tribe by the Mexican Government, which is endeavoring to form agricultural colonies for the Yaquis here.

This area of 1,685 square miles has all been platted and surveyed and comes under the irrigation system of the Yaqui River Land &

Water Co., an American concern which secured the original concession from the Diaz Government of Mexico.

Lying between this tract and the main valley of the Mayo River just to the south there is an area of land that lies generally higher than the deltas on either side and that may ultimately be irrigated in some portion by means of storage dams on various arroyos, such as the Coroachi, etc.

*Water provision.*—The Yaqui River has a storage capacity of 500,000 acre-feet, at a cost of about $3,000,000 United States currency. Under the plans of the Yaqui River Land & Water Co. there are 3,000,000 acres of land available for irrigation under their main canal alone, and the difference between the flood volume and the extreme dry-season volume of water in the stream is so great that storage must be provided to irrigate all the land available. (This same problem is faced in all the river valleys of the West Coast except that of the great Santiago in Nayarit, where rainfall is more adequate.)

*Yaqui Valley irrigation project.*—In 1909 the Richardson Bros. Construction Co. of California (Los Angeles) had completed 25 miles of main canal, 15 miles of main laterals, 15 miles of secondary laterals, 15 miles of tertiary laterals. One hundred miles of secondary laterals and 375 miles of tertiary laterals were to be completed by January 1, 1910. This water provision was to irrigate a total of 84,000 acres of level land, 10,000 acres of which were then under completed laterals. In 1907 there were only about 750 acres in crop in the valley, near a point called Ontagota. The river itself runs for more than 500 miles through a more or less arid country from its water supply in the mountain range in Chihuahua, the loss being estimated at 250–77, proportionate ratio.

*Soil conditions in Yaqui Valley.*—As in all the river valleys of the West Coast of Mexico, two distinct types of soil are found, as is the case generally on the coast, though farmers claim that there are really three types of soil, called "red soil," "chocolate soil," and "silty gray soil." The "chocolate" soils are found under the banks of the present river channel. All types of soil are pronouncedly lime soils, capable of producing for many years without fertilization.

The heaviest soils of the entire area are the "red soils," but these are very easily tilled on account of the abundant lime content. Analysis shows them to be at the head of the list of high-grade producing soils. For fruit trees with deep tap roots the red soil is undoubtedly the best, and this is also true for sugar cane, tubers, and vegetables. Analysis further shows the entire absence of alkali or other harmful salts and a great richness in phosphates, lime, nitrogen, and potash—in short, all of the chemical elements so necessary to a healthy and sustained soil production.

The base rock of the upper watershed is uniformly metamorphosed red porphyry.

The soil surface, in places, has a tendency to bake and crack after watering, when the land is new, but this condition soon yields by cultivation.

The Yaqui River has a drainage area of some 26,000 square miles, with a mean annual rainfall of 26 inches and an assumed annual run-off of 3 inches. The annual rainfall in the delta varies between 5 and 9 inches, and the heaviest precipitation in its watershed occurs

at the 40-inch rainfall-belt contour line at an elevation in the mountains on the Pacific side of about 7,000 feet above sea level.

*Development of Yaqui Valley.*—Prior to 1890 the Yaqui Indians, in the eight "pueblos," cultivated a very limited area of land immediately adjacent to the river and subject to its overflow during the rainy season of high water. Between 1890 and 1904 several canals were built by various interests of Sonora, but the total cultivated area in any one year probably never exceeded 6,250 acres. At this time the Yaqui Valley was without a railroad nearer than Guaymas, from 30 to 70 miles distant.

In 1904 the Richardson Bros. Construction Co. was organized to build a railroad through the valley and to construct an irrigation system for a total of 750,000 acres of land, this system to include storage dam and reservoir, diverting dam and intake gates, and about 3,750 miles of distributing canals with 22,000 structures. The canals will involve a total excavation of approximately 21,000,000 cubic yards. What the company has accomplished is summarized in the following paragraphs.

It entered into a contract with the Mexican Government to construct, without subsidy or bonus, a railroad from Guaymas east through the Yaqui Valley and up the Yaqui River to Tonichi, a distance of 154 miles. It effected an arrangement with the Southern Pacific Co. under which the latter agreed to purchase the contract mentioned and to commence construction within two years. Before two years had expired the road had been completed through the Yaqui Valley, and the Southern Pacific Co. had arranged to extend the line down the West Coast for a distance of 800 miles to Guadalajara, at a cost of approximately $75,000,000 United States currency.

*Irrigation system.*—The Richardson Construction Co. entered into a contract with the Mexican Government (Madero administration) to complete, within a limited time, an irrigation system adequate to supply perennial irrigation to all available lands in the Yaqui Valley regardless of ownership. This contract was without subsidy, bonus, land grant, or other consideration to the company, except the usual exemption of import tax on materials to be used in its work, and the exemption, for five years only, of tax on its investment in the irrigation system.

The total estimated cost of the work was about $12,000,000 United States currency to provide water for the 750,000 acres of land, 150,000 acres contained in the eight Yaqui Indian "pueblos," and the 200,000 acres of privately owned land coming under the system. Up to June 30, 1917, the company had constructed a temporary diverting dam and built about 350 miles of canals, totaling in excavation approximately 3,280,000 cubic yards, and it had also built 816 canal structures.

The company has thoroughly studied and recorded the engineering phases of storing, diverting, and distributing the waters of the Yaqui River over the lands of the valley, and has plans prepared for all of this work—much of which, in fact, has already been done and approved by the Mexican Government.

It has increased the cultivable area to approximately 75,000 acres, and the completion of the tertiary canals under construction when the work was suspended will increase this to 110,000 acres.

It has opened and maintained 400 miles of dirt roads and more than 150 bridges. It has built telephone lines to all parts of the valley.

For eight years an agricultural experiment station has been operated at Esperanza at a total expense of $80,000 United States currency. The demonstration farm covers 2,000 acres. This work has been of great value in the proper selection of crops and soils, as well as in increasing production. Part of the work has included the collection of meteorological data on the valley and the watershed drained by the Yaqui River.

At the time operations were begun by the company cultivation in the eastern portion of the valley totaled 3,750 acres. This area was increased, by the development of water for irrigation, to more than 27,000 acres in 1913, when the company suspended operation, principally on account of Yaqui Indian depredations and the suspension of railway traffic through the destruction of railway facilities.

The contract rate for the delivery of water to the land, as stipulated in the Madero administration contract, is 1 peso per 1,000 cubic meters of water (about 60 cents United States currency per acre-foot), with the proviso that the Indian "pueblo" lands should receive water at one-half of this rate. At such time as the storage reservoir is completed, the rates may be increased 50 cents (Mexican currency) per 1,000 cubic meters. Water continued to be supplied to the users even during the various revolutions of the past 10 years in Mexico.

Under the terms of the present contract the company has agreed to subdivide all lands available for cultivation under the water system, and to sell these lands within a period of 15 years, no sale to exceed 5,000 acres to any one individual. It has sold an average of 100 acres each to some 300 practical irrigation farmers, who have spent about $900,000 United States currency on improvements.

The company has always reinvested the proceeds of the sale of lands in new development of the valley and has never paid a dividend during the years of its operation. In 1915 the experiment station was destroyed by the Yaqui Indians and invaluable records lost. Twelve raids in all have been made on this property, resulting in the death of some 100 persons and the destruction of about $1,000,000 worth of property.

The eastern portion of the valley is served by the temporary diverting dam and the main canal, and branches of the company's system. The western portion of the valley is served by the Vicam, Victoria, and Marcos Carillo flood-water canals, none of which has a diverting dam.

The total area of land in the valley owned by the company is 587,500 acres, 412,500 acres of which lie within the 750,000 acres of the Yaqui Valley that can be ultimately irrigated. The other 175,000 acres is located outside of the irrigable area, and much of it is hilly or salt land. Of the 412,500 acres within the irrigable area only 12,500 acres can be cultivated by the canals built thus far. This is about 2 per cent of all the land owned by the company. In this connection it should be borne in mind that the company has sold its lands about as fast as water service for them could be provided. The present noncultivable area is, in parts, suitable for grazing, but much of it can not be used for this purpose on account of the lack of water, the heavy brush, the lack of grass, and the presence of the Indians.

*Comparison with Imperial Valley.*—The Yaqui Valley, from the standpoint of the American farmer, may be compared to the Imperial Valley of southern California 10 or more years ago, in that "pioneering" is still necessary in the former and climatic, soil, and water conditions are very similar, although the Yaqui Valley gets about twice as much rain per year as the Imperial Valley and has the benefit of sea breezes during the summer months, reducing the average temperature somewhat.

The advantage of the Yaqui Valley lies in the cheapness of the good land which can be obtained for a fraction of the cost of similar land with water in the Imperial Valley but on a par, approximately, with the cost of land on the Mexican side of the Imperial Valley. (See p. 299.)

The disadvantages of the Yaqui Valley lie in the constant fear of the Yaqui Indians, the present Mexican land laws, the inherent difficulties involved in the Mexican situation, and the problems of operating in a foreign country—not to mention present marketing difficulties involved in the problem of colonization and development of the entire West Coast region of Mexico, variously discussed herein.

*Crop production and acreage.*—The irrigation district of the Yaqui Valley is divided into eight subdivisions, of which the Yaqui pueblos form one division, with a total of 2,500 hectares under cultivation by irrigation in the 1921–22 season, with 160 hectares in alfalfa, 761 in beans, 887 in corn in the summer planting and 180 in corn in the winter, or dry season, planting; 270 hectares of garbanzos, 36 of garden vegetables, and 206 in wheat (1 hectare = 2.47 acres). The rest of the total 1921–22 acreage of 14,081 hectares was distributed in crops as follows: Alfalfa, 568 hectares, or 4 per cent; barley, 279 hectares, or 2 per cent; beans, 1,511 hectares, or 11.1 per cent; corn, summer planting, 2,250 hectares, or 16 per cent; corn, winter planting, 254 hectares, or 1.8 per cent; cotton, 20 hectares, or 0.1 per cent; garbanzos, 692 hectares, or 5 per cent; garden vegetables, 67 hectares, or 0.5 per cent; orchard fruits, 62 hectares, or 0.4 per cent; rice, 2,861 hectares, or 20.3 per cent; sudan, 29 hectares, or 0.2 per cent; wheat, 5,428 hectares, or 38.6 per cent.

The total number of hectares planted in the 1920–21 season was 13,026, of which rice covered a total of 4,184 hectares and wheat 2,993 hectares.

The acreage for the last season was the largest ever grown in the valley. The wheat did very well, as it had plenty of water during the growing season and no rust was experienced as in past years. Heavy winds in April and May blew down a good deal of the wheat, adding to the cost of harvesting this crop last year.

The bean crop of the Yaqui Valley in the 1921–22 season was 50 per cent less than in the preceding year because of hot winds, which blew off the blossoms and shriveled the pods.

Expressed in acres, the 1921–22 irrigation year is reported as follows:

| | Acres. | | Acres. |
|---|---|---|---|
| Alfalfa | 1,590 | Garbanzos | 4,122 |
| Barley | 717 | Orchard products | 177 |
| Beans | 2,425 | Garden stuff | 112 |
| Corn: | | Rice | 10,460 |
| Summer planting | 3,335 | Wheat | 7,482 |
| Winter planting | 1,945 | Sudan | 55 |
| Cotton | 140 | | |

For market conditions see "Rice" and "Garbanzos" in this report.

MAGDALENA RIVER VALLEY.

The Magdalena River watershed, above the town of Magdalena (which is the first important center on the railway south of Nogales), has an area of about 204.5 square miles. The district has an annual average rainfall of 15 inches; this, however, can not be depended upon year after year, although, when uniform, the precipitation is sufficient to mature good crops of wheat. The annual run-off can not be more than 3 inches. Estimates show that the stream carried sufficient water to irrigate about 1,500 acres without storage provision. There are at present more than 2,000 acres in this district in fruit trees, wheat, "garbanzos," chiles, and garden stuff. If storage dams were provided to impound the crest flood waters of the river, enough water could be secured to irrigate about 20,000 acres, the lay of the land being very favorable.

The Magdalena River is also known by the name of "Altar." It is 384 kilometers long, having its source in the mountains of the Magdalena district.

SONORA RIVER VALLEY.

The watershed of the Sonora River comprises an area of 282.5 square miles and is reported to be without peculiar interest for irrigation development, except the pronounced artesian area located some 40 miles north of Hermosillo, already mentioned. The stream itself above the agricultural region just north of Hermosillo has an annual run-off of 30,122 acre-feet, allowing for 14 inches annual rainfall and 2 inches annual run-off. The rains are irregular from one year to another and are not dependable.

With the Rio San Miguel, above Hermosillo, which has a watershed of 407 square miles with an average minimum rainfall of about 15 inches, the Sonora River has a total watershed of 785 square miles, with an annual precipitation of 18 inches. The total acre-feet available for storage above Hermosillo would be approximately 200,000. General conditions in this region of the State are very arid, but still the district compares favorably with Syria, whose gardens have for 4,000 years been one of the wonders of the world and whose water supply from the Abana is not greater, lacking storage, than that of Hermosillo. This same problem of storage is faced by all the river valleys of Sonora. The stream disappears entirely below Hermosillo in the dry season.

Following is an account of Mexican Government projects for the Sonora River Valley.[6] Preliminary reports, in 1920 and early in 1921, by engineers engaged upon the proposed Government irrigation works on the Sonora River were encouraging. It is reported that the proposed storage dam to be located at a point called Puerto del Sol, near Ures, is entirely feasible, can be built at a relatively low cost, and will hold for storage about 80,000 acre-feet of water. It is estimated that this amount of water will be sufficient to irrigate about 65,000 acres of land, or considerably more level land than there is in the Ures Valley, so that a considerable surplus, in addition to the regular flow of the river, can go down to the proposed submerged diversion dam above Hermosillo for the irrigation of the

[6] This account consists for the most part of reports from the American consulate at Nogales, dated Nov 26, 1920, and June 30, 1921.

rich alluvial fill lands of the Sonora River Valley below Hermosillo and toward the coast.

While the surveys have not been completed, it is estimated that the dam can be built for about $2,000,000 United States currency. This low cost is due to several features, namely, the narrowness of the gorge where it will be built, and the close proximity of good materials, such as stone, sand, and good rock for the manufacture of cement, a plant for which is also planned in connection with the dam work. The dam, as projected, will be 180 feet high and 800 feet long on the top, while its bottom will be only about 200 feet long. It will be 120 feet thick at the base and will taper to about 50 feet in width at the top. Soundings so far made in the gorge indicate that the sand is only about 15 to 20 feet deep, so that it will be a comparatively easy matter to excavate down to bedrock for the foundation of the main structure.

The reservoir, when filled, will be about 10 miles long and from 1,000 to 3,000 feet wide, having the estimated capacity indicated above.

The amount of electric power that can be generated has not been computed but will be very great—amply sufficient for the towns in central Sonora. The district is rich in minerals, and the provision of cheap power and transportation will greatly stimulate the mining industry.

This structure will be the first to be built, according to the plans of the Government engineers, in the series that will constitute the "Sonora River project." Another storage dam is planned for the Sonora River and one or two for the Rio San Miguel, which joins the Sonora River just above Hermosillo. Just below the junction of the two rivers there is planned a large submerged storage and diversion dam of concrete for the purpose of bringing the large underground flow of the rivers to the surface and making the water available for irrigation.

The entire project, when completed, will irrigate, it is estimated, more than 500,000 acres of the fertile delta and alluvial fill lands of the Sonora River Valley. These lands are excellent for growing citrus fruits, besides wheat, corn, and beans, and all products of a semitropical country. According to the present plans the project will be constructed by the State of Sonora, and contracts have been made with the majority of the landowners whereby they are to transfer one-half of their land holdings to the State in return for the water service for the other half which they will retain. It is planned to sell the lands so secured by the State in small allotments to farmers for sufficient money to cover the cost of construction of the various dams and accessories. The electric-power rights are to be retained by the State for the use of schools and road building.

In June, 1921, it was reported that Mexican engineers had again been active in the survey of the Ures project described above, but the general lack of funds in the State treasury and the present economic crisis of the country has made any new work of this nature impossible at this time. Private capital is not available in Mexico to carry out such a project, and, also, the present laws and the attitude toward foreigners do not encourage such an investment from the outside.

New surveys were again made in the spring of 1922 by engineers acting for the Federal Government, and the Ures project was enlarged with a view to impounding more water, the site for the dam being the same—about 12 miles above the town of Ures. It was understood that the central Government of Mexico was pledged to carry out this work, which was to begin July 1, 1922, but no funds are available at present for such a large development undertaking.

### ORTIZ DISTRICT.

Between the towns of Hermosillo and Guaymas, along the line of the railway on both sides, there is a vast tract of level alluvial lands in the form of a great natural "sink," which could be converted into productive land by means of irrigation, either by impounding flood waters or by wells. This land has been the object of several colonization attempts in the past, but nothing has as yet resulted.

### GUAYMAS DISTRICT.

A few miles to the north and east of Guaymas there are thousands of acres of good land, which can be irrigated from wells at a depth of from 20 to 50 feet and which have been farmed on a small scale by Chinese, growing principally truck vegetables and tomatoes for export. During the years of revolution (and directly on account of the Yaqui Indian depredations) those lands have been practically abandoned.

### COLORADO RIVER DELTA LAND DEVELOPMENT.

This region includes the lands bounded on the north by the international boundary between monuments 203 and 205; on the east by the irregular line running over the sandy plain to the Puerto Isabel trail; on the south by the Gulf of California and the mouth of the Colorado River; on the west by the line following the old course of the Colorado River, which is the boundary line with Lower California. Most of this tract was owned by the Gen. Andrade estate, and the present "Colorado River delta project," formed in 1922 to develop and market these lands, contains some 200,000 acres, to water which irrigation will have to be provided either by means of pumps or from the Colorado River (also by means of pumping machinery).

The company is incorporated in Mexico under the new laws governing ownership of lands in the Republic, and American capital is interested. Being so near to the American border and easily accessible to Yuma, Ariz., it is thought that settlers can be attracted, since the land is said to be excellent for grain growing.[7]

### MAYO RIVER VALLEY.

The Rio Mayo rises in the mountains in the district of Ocampo in the State of Chihuahua. It crosses the district of Alamos, Sonora, and the Southern Pacific Railroad line at the station and town of Navojoa, coming out at the gulf at the port of Yavaros, which is now

[7] See also article in La Revista Agrícola, Mexico City, April, 1922, containing a report of a Mexican engineer, Ignacio Lopez, on the lands in Mexico coming within the new Colorado River project under the plans of the Colorado River Commission, of which Secretary of Commerce Hoover is the Federal chairman by presidential appointment. (See "New land for Mexico," appearing in the Journal of the American Chamber of Commerce of Mexico, March, 1922, p. 25.) The Lopez report gives valuable data regarding the area, location, character, and ownership of the lands in Sonora and Lower California, Mexico, which will be directly benefited by the Colorado River project.

connected with Navojoa by a new railway. Its length is estimated at 350 kilometers (1 kilometer = 0.62 mile), and its lower valley has been the scene of the greatest development in agriculture by the native element of the country, which has specialized, in this region, in the production of the chick-pea, called "garbanzo," which is a staple food product in Spain and the West Indies.

The alluvial valley of the Mayo begins at Navojoa, where there is a branch of the railway to Alamos.

The watershed area of the Mayo is estimated at 7,250 square miles. The valley contains a total of 120,000 acres of bottom lands subject to irrigation, of which some 15,000 acres can be irrigated without storage water provisions. It is estimated that 200,000 acre-feet of storage water can be developed at an expense of approximately $1,000,000 United States currency. The entire valley contains 942 square miles of soil which would be productive with water.

On both sides of the potentially productive lands of the immediate river valley there are large areas of unproductive lands lying too high to permit of development. On a contour line running directly inland from the mouth of the Mayo River to Alamos, with a slight convex curve to the north, and reaching as far south as the Sinaloa River, there is an area of approximately 1,256 square miles of lands that would be valuable for farming if water could be provided. This area contains the "haciendas" of "Malacate," "Masaiva," "San Antonio," etc.

The Mayo Valley has also been the scene of the greatest irrigation development by native Mexicans, a total of 16 canals, owned privately or by associations, having been constructed by the various landowners and canal associations to date. Their names and facts concerning them are given in the following table:

[1 kilometer=0.62 mile.]

| Names of canals. | Length. | Water carried per second. | Total land irrigated. |
|---|---|---|---|
| | *Kilometers.* | *Cubic feet.* | *Acres.* |
| Los Pobres | 9 | 35.31 | 2,470 |
| Orantia and Quiros | 10 | 70.62 | 1,728 |
| Rosales | 11 | 106.00 | 4,446 |
| Morales and Garcia Pena | 9 | 141.24 | 1,976 |
| Chichivo | 8 | 106.00 | 988 |
| Amaparam | 9 | 106.00 | 988 |
| Companichica | 6 | 53.00 | 617½ |
| Compañía Agricola de la Paz | 7 | 141.24 | 494 |
| Bacobampo | 12 | 176.50 | 4,970 |
| San Pedro | 9 | 353.00 | 2,964 |
| Toriscahoso | 8 | 141.20 | 482 |
| Independencia | 12 | 197.00 | 4,075 |
| Naranjo | 7 | 141.00 | 500 |
| Santa Barbara | 11 | 48.00 | 741 |
| Tres Hermanos | 12 | 26.50 | 494 |
| Camoa | 9 | 5.30 | 148 |

All the above canals are of the gravity-flow type and take the water directly from the river—planting of the "garbanzo" being by the "bolsa" system of water conservation on the land. The canals take the water from the river on both sides, all the way from above Navojoa down to the town of Etchocoa. Many of these small canals have been built by the landowners under a mutual water agreement which divides the supply among them as it is needed.

There is not sufficient water in the river during the dry season for irrigation by means of these canals, which only serve to impound the water in the fields during the rainy season and for about a month afterwards when there is a flow.

STATE OF SINALOA.

The table below shows the irrigation water supply of Sinaloa:

| Streams. | Acres of bottom land. | Acres of irrigable area without storage. | Acre-feet of water. | Estimated cost of storage. |
|---|---|---|---|---|
| Fuerte | 130,000 | 60,000 | 96,000 | $570,000 |
| Sinaloa | 90,000 | ..... | 180,000 | 1,000,000 |
| Mocorito | 25,000 | ..... | 50,000 | 500,000 |
| Culiacan | 80,000 | 20,000 | 167,000 | 500,000 |
| San Lorenzo | 80,000 | 20,000 | 130,000 | 633,000 |
| Elota | 30,000 | 3,000 | 50,000 | 250,000 |
| Piaxtla | 20,000 | 10,000 | 24,000 | 150,000 |
| Quelite | 5,000 | 1,800 | 6,000 | 57,000 |
| Total | 460,000 | 114,800 | 703,000 | 3,660,000 |

NOTE.—The irrigable area referred to relates to intensive cultivation, such as sugar cane, alfalfa, etc., and not to such crops as corn, beans, etc.

The above table was compiled by a hydrographic engineer in 1909 for the Southern Pacific Railroad of Mexico. Since then the Rosales Canal has been constructed in the Culiacan Valley at a cost of 2,200,000 pesos (with an additional 800,000 pesos needed to complete it), furnishing water to 62,000 hectares of land (1 hectare = 2.47 acres).

LOCATION OF AGRICULTURAL LANDS.

The agricultural lands of the State of Sinaloa extend along the coast throughout the entire length of the State and are in the river valleys, of which there are eight major ones. In places heavy foothill ranges reach to the sea and the coastal plain becomes much narrower toward the south, disappearing at Mazatlan and continuing again farther south. One of these formations intervenes along the Fuerte River to the north of the stream; there is another group of hills around Sinaloa City and still another between the railway and the sea at Palos Blancos, with a scattered formation inland from Culiacan and also south of the Piaxtla and Quelite Rivers, extending to Mazatlan.

FUERTE RIVER VALLEY.

The Fuerte River Valley begins at the town of San Blas, Sinaloa, on the railway, as the apex of a triangle which ends at the mouth of the river just north of the port of Topolobampo and merges with the Sinaloa River delta to the south.

*Watershed area, etc.*—The watershed area of the Fuerte River is estimated at 15,145 square miles. The entire area of the valley is 5,240 square miles, of which the arable area is 781 square miles and the present cultivated area about 65 square miles. Two hundred and thirty-four square miles are irrigable, requiring, according to estimates, 675,000 acre-feet of water. The average annual run-off of the river is 4,480,000 acre-feet of water. Two proposed storage dams exist—one near the town of Choix, and another lower down

near the city of Fuerte at a point called Yecarati—to provide a total of 96,000 acre-feet of water at an estimated cost of $570,000, United States currency.

The total population of the Fuerte district is, roughly, 45,530, with an agricultural population of 7,933, according to the census of 1910.

*Rainfall and climate.*—The rainfall increases from the Yaqui Valley, where it is 9 inches, to something like 40 inches at Mazatlan, along the coast toward the south. The Fuerte River Valley has a decided advantage over all the other West Coast river valleys in that the river heads so far up in the heavily timbered sections of the Sierra Madre Mountains that its flow continues later into the summer dry season and is more uniform.

The average annual rainfall may be said to be 17 inches, although this varies considerably some years and the mean precipitation can not be depended upon for agricultural purposes. The rainy season is from July to October, during which time the temperature is often as high as 100° F. but never higher than 104°. From October to June, which is the dry season, it rarely rains in the normal year, although about once in every eight years there is a precipitation of 3 to 5 inches in the months of January or February, sufficient to cause damaging floods. During this season of the year the temperature varies from 50° to 85° F., with seldom any frost. Some years, however, in December and January, frosts occur of sufficient intensity to damage tomato fields severely, losses being estimated at from 10 to 20 per cent. A climatic peculiarity of the West Coast, and particularly of northern Sinaloa, is the great variation in temperature between day and night, changes from 90° F. at noon to 26° at midnight being frequent during December, January, and February of some years. The prevailing winds at all seasons are from the southwest.

*Population.*—The resident population of the valley is about 3,000, in addition to which there is a floating population of as many more, coming and going with the opening and closing of the sugar-grinding and tomato-packing season. The only towns of any importance are El Fuerte, San Blas, Los Mochis, and Topolobampo.

*Transportation.*—This is furnished by the Fuerte Division of the Kansas City, Mexico & Orient Railroad, which runs the entire length of the valley, 100 kilometers (1 kilometer = 0.62 miles) from the town of El Fuerte at the foot of the Sierra Madre range to Topolobampo on the Gulf of California. Trains are run every other day connecting with the Southern Pacific of Mexico Railroad at San Blas. Both of these roads are of standard gauge.

The valley has a seaport at Topolobampo on the Gulf of California. This is a large landlocked harbor and is an excellent deep-water port inside, but a series of sand bars across the entrance to the harbor prevent the passage of any vessel of more than 16-foot draft. The Compañía Naviera Mexicana furnishes a service of two boats a month to Mexican West Coast ports and to California ports in the United States.

*Industries.*—The only industries of the valley are agriculture, a little live-stock grazing, and the manufacture of sugar. By far the largest crop is sugar cane, followed in importance by tomatoes, alfalfa, garbanzos, corn, beans, chile peppers, and a small acreage in canteloupes and other winter vegetables. All agriculture, with the

exception of corn and beans, is, of course, carried on under irrigation, the water being taken from the Fuerte River. The dominant industry of the valley is the production of sugar cane and the manufacture of sugar, principally by one American company.

*Operations of United Sugar Companies at Los Mochis.*—Here in the Fuerte Valley is one of the largest sugar plantations in Mexico, containing 11,000 acres of cane already under cultivation, the production in the 1921–22 grinding season amounting to 17,825,075 kilos (1 kilo = 2.2046 pounds) of refined sugar. This plantation is the property of the United Sugar Companies, S. A., an American company incorporated under the laws of Mexico, with its mill and office at the town of Los Mochis in the lower portion of the valley, 25 miles from San Blas and 10 miles from Topolobampo.

The lands producing cane are divided into five plantations of about equal size, located at Ahome, Florida, Constancia, Sufragio, and Los Mochis, the last being the largest. The soil of the valley, away from the immediate vicinity of the river, is of a clay formation, hard to prepare, but excellent for the production of cane and said to be some of the best sugar land in the Republic. The average production of the land, without fertilization, is 21.56 metric tons of cane per acre, and this can be considerably increased with artifical fertilization, which is now beginning to be used. Some of the best lands of the company near San Blas produce 40 and 50 tons of cane per acre.

All the producing lands are irrigated from the Fuerte River, 75 per cent of the water of which is controlled by the sugar company through an old concession from the Mexican Government. Four pumping plants are operated, furnishing water to the five haciendas previously mentioned. At Sufragio there is a 15-inch pump furnishing water to 1,500 acres of land; at Constancia there are two 15-inch centrifugal pumps; at Las Tastas there are two pumps, one 30-inch and one 48-inch 500 horsepower steam pump, supplying water to the Los Mochis hacienda, 11 miles away; and at Aguila there is one 48-inch pump, 500 horsepower Diesel engine, and one 30-inch, 200 horsepower pump, pumping water to the Aguila and Florida haciendas.

*Cultivation.*—Tractors are used for plowing, it being claimed that the best results are obtained by the use of an English tractor (Fowler) of a special type, the use of which follows a system whereby two tractors are placed one at either side of a field, there being under, and attached to, each tractor a large cable spool wound with cable. The loose ends of these cables are attached to both end of a double-ended plow, which is thus pulled from one side of the field to the other by the tractor power which is all applied to the cable spools. This is said to be a cheaper and more effective method than the use of the ordinary tractor plow, as all the power of the tractor is applied to pulling the plow and none to moving the tractor, except from time to time when the tractors are moved forward for a short distance. A cheap fuel for tractor use is found in the "Pitahaya" cactus, which grows in large quantities on the company's property, the only expense involved in its use being the labor in cutting and hauling it. Several gas tractors are in use, but the availability of the cactus fuel makes the use of the steam tractor much more economical for the present. Four caterpillar tractors are owned by the company, but their use is not found very satis-

factory because of their weight and the hardening effect that they have on the newly plowed clay soil over which they pass. The average depth of plowing is 22 inches.

Fertilization of the land was started about three years ago, since which time the company has been using a special fertilizer compound adapted to sugar lands, the chief ingredients of which are phosphate and nitrogen fertilizers. Some bat guano, of which considerable quantities are found locally, is also used.

Some of the fields of the company have been under cultivation for 30 years. Planting is done every three years, with intervals of rest from time to time over a period of years, although there is some land in the valley that is still producing cane from a single planting of 20 years ago. Different sections of the property are replanted each spring and fall, so that a continuous supply of cane is available. The cane matures and is ready for grinding a year after the first planting—the spring planting being ground in the following spring and the fall planting the following fall. Grinding is done in the months of December, January, February, March, April, and May.

Three species of cane are produced at present—the native cane, which is called "Pinta" or "Rayada" cane; an early maturing cane, classified as "D–74"; and "Chrystalina" cane. Experiments are being made with a cane imported from the Hawaiian Islands, classified as "H–109." This is expected to acclimate itself to local conditions and will be producing in milling quantities in two years' time. Considerable difficulty is being experienced at present with the cane-bore pest, although this is being successfully combated with a parasite imported from Cuba for the purpose. The total cane production last year amounted to 199,950 metric tons, of which 10,000 tons were kept for planting.

*Railroad connecting haciendas.*—The five haciendas are connected by a standard-gauge railroad owned and operated by the company, comprising 45 kilometers (1 kilometer = 0.62 mile) of trackage, with more under construction. In addition, there are 7 kilometers of narrow-gauge road operated by mule power. These roads are used to haul the cane from the haciendas to the mill at Los Mochis. The equipment includes 4 locomotives, 74 steel cane-hauling cars (each of 40 tons capacity and said to be the largest type in use in the sugar industry), 10 flat cars, and 2 box cars. Wagons are used to haul the cane from the fields to the railroad, there being on the company's property 114 kilometers of road, constructed at a cost of 600 pesos per kilometer.

*Description of sugar mill.*—A large and well-equipped steam-driven sugar mill, valued at $2,000,000, is operated by the company at its headquarters at the town of Los Mochis. This mill, which has a grinding capacity of 60 metric tons of cane per hour or 1,440 metric tons in a 24-hour grinding day, was designed and installed by a New York iron works, extensive additions being made to the plant during the year. The product of the mill is of the grade known as "Plantation White" and is about equally divided in amount between granulated and cube sugar.

The following is a brief statement of the principal components of the mechanical equipment of the mill:

One "Meinckie" type intercarrier, for carrying the cane from the unloading pits into the mill.

One 100-horsepower motor knife, for cutting the cane into pieces and spreading it into an even mat preparatory to entering the crushers.
Two Fulton 18-roller mill double crushers. Independently driven, steam power.
Five 36-inch Schreiber presses.
Five Sweettland presses.
Two Connelly boilers, 500 horsepower each.
Four Sterling boilers.
Three 10-foot-diameter sugar pans.
One 7-foot-diameter sugar pan.
Quintuple effect evaporators, 18,000 square feet of heating surface.

The "bagasse," or crushed cane waste remaining after the juice has been extracted, is used for fuel in making steam power for the operation of the machinery of the mill. The average moisture content of the bagasse here is found to be 45 per cent, with a heat content of 4,000 British thermal units per pound. The average fiber content is 10 per cent.

In connection with the sugar mill the company operates a distillery for the manufacture of alcohol, with a capacity of 14,000 liters per day and a production last year of 1,719,000 liters of alcohol. The equipment of the distillery is of French manufacture and consists of nine vats, one rectifier, and one distillery. (The two last named bear the mark "Rectificateur Continu Système Guillaume Brevers, Egrot, Paris.") A small can factory turning out 5-gallon cans for canning the alcohol product is also operated. In addition, the company operates an ice plant, producing 5 tons of ice per day, some of which is sold in near-by communities, and an electric power plant producing light and power for the private use of the company, none being sold.

*Labor and wages.*—Native Mexican labor is used in both the cane fields and the sugar mill. The field laborers are paid by the task system; that is, so many furrows constitute a day's work for a man handling a plow, etc. The average wage is 1.50 pesos ($0.75 United States currency) a day, or 90 centavos ($0.45 United States currency) a day, with privileges at the company's commissary stores. Most of the field laborers employed by the company live on the property in little villages on each hacienda. During the grinding season 3,000 people are employed, and about half that number during the rest of the year. With the exception of several American foremen the mill employees are all Mexican and are said to be excellent mechanics for this class of work. About 20 Americans are in the employ of the company in various administrative capacities.

*Sales of sugar produced.*—An ample market for all the output of the company's mill is found in the interior of Mexico, none being exported. Transportation to market is via the Fuerte Division of the Kansas City, Mexico & Orient Railroad from Los Mochis to San Blas, the Southern Pacific of Mexico from San Blas to Nogales, Ariz., the Southern Pacific to El Paso, Tex., via Tucson, Ariz., and from El Paso south into central Mexico over the Mexican National Railways. A little is shipped by water through the port of Topolobampo to Manzanillo, and from there to Mexico City by rail. By far the greater part, however, goes by way of El Paso, and is stored there in bond pending distribution, the reason for this being the requirement of American banks that the sugar be stored in the United States before it will be regarded as security for the advancement of money.

*Land holdings and values.*—The total land holdings of the United Sugar Companies comprise approximately 400,000 acres, extending from the town of El Fuerte at the edge of the Sierra Madre Range down to the coast at the Bay of Topolobampo, which opens into the Gulf of California. As previously stated, 11,000 acres are now under cultivation in cane, the rest being devoted to cattle grazing, with a small acreage in alfalfa and mixed vegetables. Alfalfa and cow peas are frequently used for cover crops on the cane fields. At present the company owns 2,150 head of cattle and 1,426 head of other live stock, principally horses and mules.

Proved sugar land already under cultivation in cane is valued by the company at $150 to $200 an acre, uncleared land readily available for irrigation is valued at $100 an acre, and land farther from the water supply at $40 and $50 an acre. The cost of clearing land is said to be about $15 per acre and the cost of clearing, cultivating, and bringing to the stage of cutting 1 acre of cane, $100. This includes administration and overhead but does not include fencing, which is not used by the sugar company except along roadways, around experimental fields, etc. At present it has 300 kilometers of four-strand barbed-wire fencing, constructed at an average cost of 350 pesos per kilometer.

*Probable extension of "colono" system.*—The company at present raises all its own cane with the exception of the production of about 800 acres, which is bought from nearby "colonos," or colonists, both Mexican and American, although at present there are only two of the latter producing cane for the sugar company. This cane is paid for at the rate of $5 per ton, delivered at the company's railroad. It is desired to have more cane raised by the colonists in the valley to increase the supply for the company's mill, and there is now being opened up a 1,000-acre tract, which is being sold in small plots to some of the Mexican and American farmers in the valley. The company is giving the use of the land rent free for one year in return for having it cleared and placed under cultivation, and if the lessee under this arrangement desires to keep the land after the first year he will be given 10 years in which to complete payment, the land being sold at about $150 per acre. Experiments are being made with Japanese colonists, six families of these being already on one of the company's haciendas, working under a somewhat similar arrangement, and if these are successful it is probable that more will be brought in.

*Capital and investment.*—The United Sugar Companies has a capital of 16,000,000 pesos ($8,000,000 United States currency) and an estimated total investment to date in the Fuerte Valley of $12,000,000 United States currency.

In addition to the plant of the United Sugar Companies there are near Aguila two other small mills of 200 tons per day capacity. One of these is owned by an American concern, the Mexican-American Sugar Co., of Los Angeles, Calif.

*American colony.*—There is in the Fuerte Valley a small American agricultural colony, founded 35 years ago, and now comprising about 25 families, or between 150 and 200 individuals. These colonists are spread over almost the entire valley, although the greater number are in the vicinity of Los Mochis. The principal crop raised is tomatoes, of which several hundred carloads are shipped annually to the

United States. In 1921 there were 2,480 acres planted in tomatoes, 700 acres in alfalfa, 25 or 30 acres in canteloupes, and some land in chile peppers and mixed winter vegetables. The rest of their land is either used as grazing land or is not yet in use. Two cooperative marketing associations are maintained by these colonists, the Mochis Agricultural Union and the Unión Agrícola del Rio Fuerte. These associations are particularly active in packing and marketing tomatoes, although the former expected to sell about 2,500 tons of alfalfa hay this year. The rest of the tomato crop is handled principally through local representatives of two American commission houses.

*Import and export trade.*—The import trade of the valley is small and consists entirely of American goods brought in through Nogales, Ariz., over the Southern Pacific of Mexico Railroad. The only importers of any size are the United Sugar Companies, bringing in some goods for commissary stores, and a branch at San Blas (at the head of the valley) of a wholesale house of Mazatlan. The retail trade is in the hands of a number of small Mexican and Chinese stores. The products imported are chiefly general merchandise, agricultural implements, and a few automobiles.

In addition to the tomatoes, other vegetables, and hay, previously mentioned, the only exports are dried shrimps, of which about 150 tons are shipped each year from Topolobampo, the industry being entirely unorganized and in the hands of a number of native fishermen around Topolobampo. The shrimps are shipped principally to China and Japan by way of San Francisco.

*Future development of valley.*—Any important expansion in development activities in the Fuerte Valley will be dependent upon further development of the water resources of the valley. Cultivation is now approaching the limit possible with the available water supply, but this can be greatly increased at reasonable expense by the construction of a storage dam on the upper waters of the river or its largest tributary in the Sierra Madre Range. Several projects of this kind have been considered, and some action toward the construction of such a dam will undoubtedly be taken within the next few years, preliminary surveys of likely sites having already been made.

No great increase in the size of the American colony can be expected under existing legislation in Mexico, as the greater part of the valley lies within 50 kilometers from the seacoast, the zone in which foreigners are prohibited from owning lands under the provisions of Article 27, of the Constitution of 1917. Practically all American landowners now in the valley secured title to their properties prior to the enactment of this Constitution.

Another factor likely to retard development in the Fuerte Valley is the recent completion of the Rosales Canal on the Culiacan River, near the town of Culiacan, 197 miles south of San Blas. This has brought under irrigation 150,000 acres of rich farming land, which can be bought at a low price—in some cases as low as $15 (United States currency) per acre. This is well-located, raw land with approximately the same transportation and marketing facilities as the Fuerte Valley, and, apparently, it should tend to attract new settlers to the Culiacan Valley in preference to the Fuerte and other river valleys of the West Coast.

### SINALOA RIVER VALLEY.

The Sinaloa River delta lands begin at the railway station and town of Bamoa and spread in a fan-shaped area to the coast, the formation being similar to that of the other river valleys of the West Coast. The total watershed contains some 5,400 square miles, the valley district being estimated at 3,930 square miles, of which the arable area is 750 square miles and that under cultivation approximately 62 square miles. A total of 180 square miles are irrigable with 51,800 acre-feet of water.

The total population of the Sinaloa district is 43,432, of which about 7,854 people, according to the census of 1910, are agricultural.

Storage projects call for 180,000 feet of water at a cost of $500,000 United States currency. The average annual run-off of the river is 2,030,293 acre-feet.

Along the lower reaches of the Sinaloa River—including within this estimate the Cabrera Arroyo and the Ocoroni Arroyo—there are some 150,000 acres of prime-quality land that would be susceptible to irrigation in case the water supply were to be developed. Such provision is very feasible with the expenditure of a reasonable amount of money in providing storage reservoirs near the mountains. A considerably larger acreage, including lands of a rather heavy clay base soil, could be cultivated also if it were practicable to supply water for their irrigation. Much of the 150,000 acres mentioned lies on the right (north) bank of the stream in the northern and western sides of the delta; the smaller portion, some 30 per cent of the total, lies on the left bank on the southern side of the valley.

At the present time about the only use of water from the river has been confined to gravity ditches—taking the water out of the stream at high water and flooding the lands lying along the river bottoms during the season of flood water—and also certain ditches for the purpose of diverting the ordinary dry-season flow, their construction being of a temporary character and only serving low lands near the river itself. All the river delta lands of the Sinaloa could be dyked and checked and covered with the silt-bearing waters of the flood season each year. This system is used successfully in the valley of the Mayo River and also in the Yaqui Valley for great crops of "garbanzos."

### MOCORITO RIVER VALLEY.

The drainage area of the Mocorito River covers 470 square miles above the 30-inch rainfall-belt elevation. The annual run-off of the river is 243,200 acre-feet of water. The district contains 2,485 square miles, of which 340 square miles are arable and 47 square miles at present under cultivation. Forty square miles are irrigable, with the provision of 115,000 acre-feet of storage water.

The best lands of the Mocorito Valley extend in a wide triangle with its apex at the station of Guamuchil on the railway. The total population of the district in 1910 was 28,628, of which 5,665 people were engaged in agricultural pursuits.

### HUMAYA (CULIACAN) RIVER VALLEY.

The watershed of the Culiacan River is divided into two areas. One lies northeast of Culiacan and directly inland from the Mocorito

region, its center being the town of Badiraguato, and consists of a country of many hills, creeks ("arroyos"), and more or less broken territory. The total drainage area of this section above the 30-inch rainfall-belt contour is estimated at 6,430 square miles, of which the upper, or Badiraguato inland district, area is estimated at 2,480 square miles, of which 300 square miles are arable in scattered lots, having a total of 26 square miles in cultivation in various small scattered places. Sixty square miles are irrigable below Badiraguato, requiring 173,000 acre-feet of water. This section is far removed from the railway and market centers and can be counted upon only for local consumption.

The lower division is the drainage area of the Tamazula River and the Humaya River. The valley proper of the Humaya—called the Culiacan Valley below the junction of the two rivers at Culiacan—contains something like 4,170 square miles, of which the arable area is 700 square miles and the present cultivated area approximately 56 square miles. Two hundred square miles are irrigable, with the provision of 550,000 acre-feet of water. Proposed storage dams on the Tamazula at a point called Agua Caliente (near the town of Tamazula) and at Monte Larga (near La Bajada and farther up the stream) would provide 167,000 acre-feet of water at an estimated cost of $1,115,000, United States currency.

The average annual run-off of the combined Humaya and Tamazula Rivers at the mouth of the Culiacan River (Altata) is 1,985,280 acre-feet.

The total agricultural population of the upper section is placed at 3,135 and that of the lower section at 6,783. The total population of the upper district is 18,023 and that of the lower section 44,324.

### SAN LORENZO RIVER VALLEY.

The watershed area of this river is estimated at 1,391 square miles, with an annual average run-off of approximately 1,920,000 acre-feet of water. A storage dam at Casa Blanca (Cosala district) would provide 130,000 acre-feet of water for about 20,000 acres of land at an estimated cost of $633,000, United States currency. The total population of the San Lorenzo and Elota districts is 21,391 and the agricultural population for both valleys 3,030.

### ELOTA RIVER VALLEY.

The Elota River has a watershed of 1,610 square miles, with an annual run-off of about 339,200 acre-feet of water. The district proper contains 2,020 square miles of lands near the coast and lying toward the Piaxtla Valley, the next river to the south. The arable lands are estimated to be 111 square miles in extent, of which 25 square miles are now cultivated and 10 square miles irrigable, with a supply of 29,000 acre-feet of water. Storage for 50,000 acre-feet of water can be provided at an estimated cost of $250,000 for about 3,000 acres of good land.

### PIAXTLA RIVER VALLEY.

This watershed contains some 2,750 square miles, and the river has an annual run-off of 878,000 acre-feet of water. A total of 2,430 square miles constitute the district proper, of which 108 square miles are arable. The present cultivated area is estimated at 30

square miles, and 15 square miles are irrigable, with 43,000 acre-feet of water. The best lands of this valley lie very near to the coast. A storage dam at a point called Coyotitlan, near the railway, can be constructed at an estimated cost of $150,000 to provide 24,000 acre-feet of water for the irrigation of 10,000 acres of land. The agricultural population is 3,648, and the total population of the district 18,283, according to the census of 1910.

### QUELITE RIVER VALLEY.

The drainage area of this stream is included in that of the Piaxtla River. Its annual run-off is 285,800 acre-feet. Eight square miles of the lower valley are irrigable with 23,000 acre-feet of water.

### MAZATLAN RIVER VALLEY.

On the north of Mazatlan there is an area of some 220 square miles, of which 90 square miles are arable, with 18 square miles in cultivation at present. The total population of the district is 38,298, of which approximately 3,650 are engaged in agriculture.

### CONCORDIA DISTRICT.

This district lies just south of Mazatlan and has a drainage area of 17,817 square miles, of which 1,110 square miles are considered "valley" lands. Forty-three square miles are arable, and 21 square miles are now under cultivation. No irrigation has been developed except from small arroyos. The rainfall in the region south of Mazatlan is sufficient to mature crops of winter tomatoes without irrigation.

### CHAMELA RIVER VALLEY.

This valley has good land subject to irrigation near the coast in conjunction with the Esquinapa district just to the south. The total area of the valley is 2,390 square miles, of which 129 square miles are arable, and the present cultivated area is said to be about 40 square miles. No irrigation has been developed.

## STATE OF NAYARIT.

This country is a continuation of the West Coast territory and has several important river valleys. The most important of these rivers—and, in fact, the largest in Mexico—is the Santiago, which flows through the State of Jalisco and Nayarit, reaching the Pacific Ocean just north of the seaport of San Blas.

### CLASSIFICATION OF LANDS.

Since the rainfall increases to the south along the coast, the State of Nayarit, in its central part, has an annual average rainfall of from 32 to 48 inches, making irrigation unnecessary for the immediate river-bottom lands. The surface area of the State is 28,371 square kilometers (10,954 square miles), with a coastline on the Pacific of 180 miles, along which there is a considerable area of tidal lands, 40 kilometers wide, partially subject to overflow (1 kilometer = 0.62 mile). Topographically, the State is a great table-land of an average elevation of 1,000 meters (1 meter = 3.28 feet), with extensive plains crossed by mountain ranges in which rise a number of unimportant streams. There are about 979,300 hectares (1 hectare = 2.47 acres) of arable lands, subdivided as follows: Agricultural lands not subject

to irrigation, 750,000 hectares; moist, subirrigated river-bottom lands, 194,000 hectares; lands subject to irrigation, 35,000 hectares. Pasture lands are placed at 230,000 hectares, forests at 380,000 hectares, and waste lands at 1,165,000 hectares, with a total of 175,388 hectares allowed for the overflow lands along the coast, etc.

The State of Nayarit has three mountain divisions. The western Pacific division contains the Sierra de Vallejo and the Sierra Alta de San Juan. The central division is composed of the Sierra de Zapotan, the Sierra del Carreton, Juanacate, Volcan de Ceboruco, de San Pedro, Sanganguay, Picacho, Acatan, Colorado, and San Francisco. The eastern division is part of the Sierra Madre chain, containing the following groups in Nayarit: Buenavista, Palmas, Berberia, and the Sierra de Nayarit, the last named having the highest peaks in the State.

### SANTIAGO RIVER VALLEY.

No hydrographic data on the annual run-off, etc., of the Santiago River are available, but the river carries a very adequate volume of water throughout the year, sufficient to irrigate all the lands subject to irrigation, its flow being greater than that of the Fuerte and more constant throughout the year. Thirty thousand hectares (74,130 acres) of the lands of the San Lorenzo hacienda alone were to be irrigated in 1912 by the gravity canal then under construction, and the San Pedro Valley, just to the north, had 12,000 acres more to be brought under water service by the canal planned and begun on that stream about the same time. The combined San Pedro and Santiago Valleys may be said to be fully equal to either the Yaqui or the Fuerte valley in extent of good river-bottom lands, and the total absence of frosts and more adequate rainfall give the Nayarit country advantages not found farther north along the West Coast. In fact, it is the general opinion of the agriculturists and land people who know the entire West Coast of Mexico that the Santiago Valley is the richest of them all, and it is also the least developed, because development by Americans has been from the north and has not as yet reached this region. (See p. 172.)

### OTHER VALLEYS.

The Ahuacatlan and Jala Valleys have a combined extent of 150 square kilometers, with an average elevation of 1,095 meters above sea level. The Compostela Valley contains 160 square kilometers, with an average elevation of 840 meters above sea level. The La Labor Valley contains 100 square kilometers, with an average elevation of 980 meters. The Banderas Valley, situated on the right bank of the Ameca River, contains 110 square kilometers. The Calabozo and Las Varas Valleys contain a combined area of 357 square kilometers, with an average elevation of 8 meters above sea level. The San Blas plains cover 268 square kilometers, with an elevation of 4 meters. In Nayarit the Santiago and Tuxpan Valleys contain 1,660 square kilometers, having an average elevation of 15 meters, and are watered by the largest rivers of the State. The Rosa Morada plains farther to the north have an average elevation of 20 meters and contain 1,070 square kilometers. The Acaponeta and Tecuala plains contain 1,310 square kilometers and have an elevation of 22 meters above sea level. The Valle de Matatipac, southeast of Tepic, contains 120 square kilometers and has an elevation of 950 meters.

RIVERS AND STREAMS.

Nayarit has a total of 17 rivers and streams, 10 of the principal ones flowing into the Pacific.

In their geographical order from north to south, the first is Las Canas, which forms the boundary between Nayarit and Sinaloa. This stream rises in the Sierra Madres in Durango, its length is 99 kilometers, its mouth the Estero de Teacapan, and its estimated watershed area 59,500 hectares.

The Rio Acaponeta has its source north of Acaponeta near the Durango State line, and in its course it passes the towns of Quiviquinta, Huajicori, Acaponeta, Tecuala, San Felipe, and Quimiches. Its length is 147 kilometers, and its mouth the Estero de Teacapan. The estimated area of the watershed is 214,200 hectares (1 hectare = 2.47 acres).

The Rio San Pedro also has its source in the Durango mountains and passes the towns of Ixcatan, San Juan, Corapa, Venado, Vado de San Pedro, and Tuxpan. West of Tuxpan this river divides, forming the Estero of Las Corrientes, and the main channel flows into Lake Agua Dulce. The watershed area is 437,900 hectares.

The Rio Grande de Santiago enters Nayarit at a point called Analco in the Canton of Ahualulco, Jalisco. Its source is in the Laguna de Lerma in the State of Mexico, and the stream is called the Rio Lerma until it reaches Lake Chapala in the State of Jalisco. Its course in Nayarit is 265 kilometers long. The principal tributaries of the Santiago are the rivers Bolanos, Amatlan, Palmillas, Aguapan, Toro Macho, Huaynamote, and Cahuipa.

The principal affluent of the Santiago is the Rio Tepic, which has a length of 58.5 kilometers and a watershed area of 46,400 hectares. Three kilometers north of the city of Tepic it has a waterfall over a basalt dike.

In the rainy season the flood waters of the Santiago inundate the land for 18 kilometers on either side of the river throughout 50 kilometers of its lower course. The estimated watershed area in Nayarit is 1,286,400 hectares.

WATERFALLS.

The largest waterfall in the State of Nayarit is that called Jumatan, or Ingenio, on the Rio Barranca Blanca. This fall is 120 meters high and is capable of developing 7,000 electrical horsepower during the rainy season and a total estimated 3,000 horsepower continuously if a dam were provided.

The waterfall of the Rio Tepic, 3 kilometers from that city, has a fall of 26 meters.

Other waterfalls include the Salto de Jihuite on the Rio Zaponito, near Santa Maria de Oro, and others on the Rivers Guaynamote, San Pedro, Acaponeta, etc.

## CLIMATIC CONDITIONS AFFECTING AGRICULTURE.

On the Pacific coast of the United States the rainfall increases along the coast toward the north, reaching its maximum at the boundary with British Columbia and its minimum in the extreme southern part of the State of California and in Arizona. This latter desert region continues down into Sonora and gradually gives way to an increasing rainfall down the West Coast until the maximum is

reached at Panama. For example, the rainfall at Guaymas is only about an average of 5 inches per year; in the Yaqui Valley 40 miles to the south it has increased to about 9 inches per year; it is 26 inches a year at Culiacan at the head of the Culiacan River Valley; it is over 30 inches at Mazatlan; Tepic, in the central part of Nayarit, has from 32 to 48 inches of rainfall; and the Acapulco district still farther south gets, some years, a total of 60 inches of precipitation.

From the coast toward the mountains the same variations are found, the rainfall increasing steadily with the elevation and reaching a 40-inch belt at an average elevation of about 7,000 feet above sea level. The rains in the mountains are more reliable and of more constant volume every year, but throughout the coastal plain there is a great variation, which at times amounts to 10 inches from one year to another. In some years the rainfall there is insufficient to mature even rainy-season corn crops in the Culiacan Valley.

### SEASONS.

There are only two seasons, the wet and the dry. The rains begin in the central part of the West Coast about the end of June in a normal year and continue until about the middle of September, when the showers become less frequent and gradually disappear entirely. October, November, December, and January are dry months. Light but steady rains occur during the spring equinoctial season in February or early in March and last about two weeks, giving a total additional precipitation of from 3 to 5 inches, although the latter figure is abnormal. This spring rainfall is not sufficient to make crops except those planted on subirrigated river-bottom land called "verano" land by the natives.

Throughout the coast the heat is very great from March to November. Frosts occur as far south as Mazatlan in December and January. The only frostless country on the West Coast begins toward the coast in the Santiago Valley region, and here bananas can be grown without damage, except that the drop in temperature during the winter months seriously retards the growth of this plant as compared with Costa Rica, Colombia, etc.

### RAINFALL TABLES.

The tables below furnish some idea of the climatic conditions of average temperatures, rainfall, etc., at the principal points of the West Coast. The first table, which follows, shows the rainfall at Culiacan, Sinaloa:

| Month. | 1903 | 1904 | 1905 | 1906 | 1907 | 1908 | Average. |
|---|---|---|---|---|---|---|---|
| | *Inches.* | *Inches.* | *Inches.* | *Inches.* | *Inches.* | *Inches.* | *Inches.* |
| January | 0.68 | ..... | 0.43 | 0.67 | 0.53 | 0.00 | 0.38 |
| February | 3.01 | 0.00 | .42 | 1.20 | .00 | .34 | .83 |
| March | .00 | .00 | .05 | .03 | .00 | .00 | .01 |
| April | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| May | .00 | .00 | .00 | .00 | .00 | .00 | .00 |
| June | .31 | .65 | 1.71 | .54 | .00 | 1.50 | .78 |
| July | 5.27 | 5.31 | 5.87 | 3.43 | 6.06 | 7.26 | 5.53 |
| August | 5.30 | 4.87 | 6.58 | 10.70 | 12.70 | 4.62 | 7.46 |
| September | 2.10 | 5.59 | 8.89 | 3.66 | 1.73 | 4.62 | 4.43 |
| October | .39 | .22 | .00 | 2.10 | 3.35 | .00 | 1.01 |
| November | .00 | .52 | 6.48 | .41 | .00 | .00 | 1.24 |
| December | .08 | .00 | 1.31 | .32 | .00 | .14 | .31 |
| Total | 17.14 | 17.16 | 31.74 | 23.06 | 24.37 | 18.48 | 21.98 |

The tables below show rainfall at Mazatlan and Tepic:

RAINFALL AT MAZATLAN.

| | 1880 | 1885 | 1890 | 1895 | 1900 | 1905 | 1910 |
|---|---|---|---|---|---|---|---|
| Number of days | 79 | 91 | 73 | 75 | 63 | 62 | 57 |
| Total precipitation.....inches.. | 34.97 | 43.95 | 26.98 | 42.85 | 33.55 | 38.45 | 42.00 |

RAINFALL AT TEPIC, NAYARIT.

| Years. | Inches. | Years. | Inches. |
|---|---|---|---|
| 1919 | 43 | 1921 | 48 |
| 1920 | 32 | 1922 (up to Sept. 15) | 37 |

STORMS—VARIATIONS OF RAINY SEASON.

During the rainy season sudden squalls may be expected, but not of sufficient duration or violence to damage property. Heavy storms are liable to occur during the season of the fall equinox (usually falling early in November and lasting about four days) all along the coast and reaching far inland. Every year these storms occur, but only in regular cycles of eight-year periods are they of sufficient violence to damage property seriously. In 1905 the rainfall registered in November was over 6 inches; streams were flooded, roads washed out, and losses heavy. In 1913 the railway was out of operation for a week or more in places, and in 1921 over 5 inches of rain fell in a few days, again in November, causing heavy loss by flood in the river valleys all down the coast.

Some years the rains do not begin according to the regular annual schedule but start about one month later, or at the end of July, and rainy-season crop planting of corn and beans is delayed by this month, especially as the native farmers do not plow the soil in a dry condition.

TEMPERATURES.

The entire West Coast is subject to great variations in temperature in the winter months between the maximum high average during the day and the low mean at night. It is not regarded as advisable to give tables of average mean temperatures during periods of years, as they tend to mislead, more especially when one is considering a delicate product like winter tomatoes—it being the minimum temperature that does the damage. The following table may be taken, however, as a good average indication of conditions in the Fuerte, Culiacan, and Mazatlan regions, the figures given being monthly averages:

| Month. | Maximum. | Minimum. | Month. | Maximum. | Minimum. |
|---|---|---|---|---|---|
| | °F. | °F. | | °F. | °F. |
| January | 82 | 57 | July | 100 | 80 |
| February | 85 | 53 | August | 94 | 79 |
| March | 95 | 53 | September | 93 | 77 |
| April | 95 | 63 | October | 93 | 62 |
| May | 97 | 69 | November | 89 | 61 |
| June | 98 | 75 | December | 82 | 57 |

A peculiarity of the West Coast winter climate is that sudden drops in temperature occur at night, registering a decline of as much as 68° within a few hours. Some years there are frosts of sufficient severity either to damage seriously or to kill fruit trees, although this is very exceptional, the winter conditions not being nearly as severe as in southern California. Records for the Fuerte River Valley (Los Mochis) show an annual high average temperature of 102° and 109° F., with the average annual minimum placed at 31° and 40° F. at two stations, one being located about 12 miles inland from the coast and the other about 40 miles inland at the head of the valley. The average daily range in temperature for the winter tomato-growing season—November to May—is placed at 55° F. In 1910 and 1911 frosts killed the tomato crops in the Yaqui Valley and that industry has since been discontinued in that section of the West Coast, but has increased in the Fuerte and other valleys farther south. South of Mazatlan there is no danger of frosts, and even in the Culiacan Valley sufficiently low temperatures to damage winter tomatoes would only occur in exceptional years at long intervals.[8] Losses of the tomato crop in the Fuerte Valley by frost have not been sufficient to hamper seriously this industry, which, in the 1922–23 season, increased to four times the acreage planted in the preceding year.

## SOIL CONDITIONS.

It has been shown that the formation of the various river valleys of the West Coast of Mexico is alluvial and very similar to the agricultural lands of California. Two distinct soil conditions have to be taken into account in considering any of the river valleys of the West Coast. The light sandy silt soils are generally found near the river beds, while the heavier soils having a clay base are found farther from the river beds and at slightly higher elevations. The latter soils predominate in area.

In the Yaqui Valley the lime content is higher than in the river valleys to the south. It has been found by experience in the Fuerte, Culiacan, and San Lorenzo River Valleys that the heavier clay-base soils produce, on an average, 50 metric tons of sugar cane per hectare, as compared with 60 tons for the more porous and more easily worked lighter soils of the immediate river bed, but that the sugar content of the cane grown on the heavier soils is higher by 15 per cent, making the additional cost of working the heavier soil well worth while.

The soils of the 10 river valleys of Sinaloa are made up of river wash from the mountains and of the low lands which are virtually tidal plains. Along the edge of the mountains the soils are composed of gravels, some coarse sands, and clays, while those of the western parts of the valleys are composed of fine silts, a heavy "adobe," and fine sands. There is practically no humus, except in the low places left by the rivers when they changed their courses.

The heavier soils seem to produce better "shipping-quality" tomatoes than the silt soils, but plant disease appears to be more rife among crops grown on the heavier soils of these valleys. There is apparently no deficiency in nitrogen content of the soils of the various valleys, but the application of guano fertilizer on tomato

[8] For more detailed climatic data, especially with regard to winter tomatoes, see p. 149.

More recent estimates for the State of Nayarit show crop production and value as follows:

| Products. | Quantity. | Value. |
|---|---|---|
| | | *Pesos.* |
| Corn ..... kilos.. | 26,600,000 | 950,000 |
| Beans: | | |
| Wet season ..... do.... | 280,000 | 115,200 |
| Dry season ..... do.... | 360,000 | |
| Sugar cane ..... area, in hectares.. | 9,000 | ..... |
| Rice ..... kilos.. | 18,000,000 | [1] 1,701,000 |

[1] 37 per cent loss in cleaning.

## COTTON.

On the West Coast of Mexico, outside of Nayarit (which was second in the production of cotton in Mexico before the industry was developed in the Laguna district near Torreon), there has been no systematic attempt to cultivate cotton on a large scale. In 1905 Sinaloa produced a total of 397,300 kilos of cotton, valued at about $22,500 United States currency. Sonora, in 1909, produced 129,700 kilos, valued at $17,575 United States currency, the total cotton production of Mexico for that year being 147,739,535 kilos, valued at $16,696,301 United States currency. That year the textile mills of Mexico were credited with a total consumption of 36,000 tons of raw cotton, which was less than the domestic production, but some cotton was still imported from Texas, possibly on account of transportation and temporary market conditions. Experiments show that cotton does very well in the State of Sonora the first year seed is planted, but that it becomes infested with the boll-weevil the second year to such an extent as to curtail the industry seriously.

A recent report on the agricultural resources of the State of Nayarit by the Department of Agriculture of the Ministry of Agriculture, Commerce, and Labor contains the following with regard to the production of cotton in Nayarit:

> This fiber is produced in the region between the northern boundary of the State and the Santiago Valley. The principal reasons why more cotton is not produced in this State is on account of the lack of a local market and the damage caused by the boll-weevil, the limited production going to the local mills and one in the State of Sinaloa (which pay very low prices), there being no other outlet on account of the absence of transportation facilities to enable Nayarit cotton to compete with production in other parts of the country. It is thought that this product has very great possibilities in this region if more interest were taken in it.

In March, 1922, it was reported that about 3,000 acres of land was to be put in cotton at Las Trincheras, a valley located just south of Altar and west of Magdalena, which latter point is the first important one south of Nogales on the border. Some half dozen Americans and several native farmers of the region were interested in this new development, it being planned to ship the product to Liverpool via Guaymas, the cotton being of a texture similar to that of the Imperial Valley and the Mexicali region of the Colorado delta lands. A fair crop when prices are rapidly advancing would greatly stimulate cotton planting in Sonora, especially as all of the West Coast needs exportable products, other than minerals, to balance imports from the United States.

Early in 1920 an effort was made to plant 1,000 acres of cotton in Sonora south of Douglas, Ariz., it being said that sufficient water could be secured for irrigation of this amount of land at that time under the "bolsa" system of irrigation. Cotton-soil experts have reported that certain of the Sonora lands will produce the famous long-staple variety of cotton which has produced profitable results in Arizona recently. It is understood that difficulties in the nature of interference by the Agrarian Commission caused this experiment in cotton growing in this part of Sonora to fail for the time being.

### COFFEE.

Only the State of Nayarit grows coffee in the territory covered by this report. Large-scale plantations number six or seven, and there are a few small individual planters. There is one German-owned plantation and one French-owned plantation in the State, and both have yielded excellent returns for years. This industry in Nayarit is thought to be capable of considerable increase. Plantations are located at elevations of 600 to 1,000 meters (1 meter = 3.28 feet) above sea level. Trees are planted 2.5 meters distant one from the other, with an average of about 1,600 trees to the hectare (1 hectare = 2.47 acres). The yield in Nayarit may be said to average 368 kilos of clean berry per hectare, and the entire production of the State is placed at 500,000 kilos (1 kilo = 2.2046 pounds), valued at an average domestic market price of 85 centavos Mexican currency per kilo, or approximately 20 cents United States currency per pound. In 1920 Mazatlan exported to the United States (San Francisco) a total of 123,257 kilos of coffee from Nayarit, valued at $33,929, and in 1921, 102,031 kilos, valued at $12,809. The Nayarit coffee is of a very good grade and often sells in the domestic market for as high as 1 peso per kilo, being sent principally to the towns of the West Coast and also to the commercial center of Guadalajara, where its grade enjoys an excellent reputation. Many of the interior valleys and foothill areas of Nayarit are heavily impregnated with volcanic ash, and conditions are very similar to those in the best coffee-producing sections of Central America and Colombia. The Pacific coast market of the United States would take a great deal more of the Nayarit coffees if more could be had.

The "Maldonal" coffee plantation in Nayarit is owned by a Frenchman, the property being managed by a German for the past 38 years. The German firm of Delius y Cía., of Tepic, owns two plantations called "Cora" and "Palapita." The 1920 crop of coffee in Nayarit was the largest ever known in that State, amounting to an estimated 500,000 kilos, some of which sold for as high as 1 peso per kilo of cleaned berry. Since then the crop has averaged about one-half of this amount.

### TOBACCO.

Tobacco is grown more or less, in small lots, throughout the coast territory, but only Nayarit has an exportable production of this article. The annual average tobacco crop of Sonora may be taken as being about 140,000 kilos, valued at 45,000 pesos; that of Sinaloa 320,000 kilos, valued at 50,000 pesos; and that of Nayarit 5,200,000 kilos, valued at 1,420,000 pesos. (1 peso = $0.50 at par.) The above valuation is at the rate of the lowest prices paid.

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Tobacco is planted on the low-lying river bottom soils during the dry season of the year. The 1920 crop in Nayarit was the largest in the history of that State, and very high prices were also obtained. It is estimated that it costs between 40 and 50 pesos to produce and market one "carga" of 300 pounds (138 kilos) of tobacco in Nayarit and Sinaloa, and in 1919, for a much smaller crop, 100 and 120 pesos were paid per "carga." In 1920 prices were about 70 pesos per "carga." The production in 1920 was 10,000 "cargas" of first-grade and 25,000 "cargas" of second-grade tobacco. The average production per hectare for the area planted was placed at 1,800 kilos.

Sinaloa produces about one-fourth of the amount of tobacco grown in Nayarit.

The bulk of the tobacco crop of Nayarit goes to the great cigarette factories of Mexico City, which also take the bulk of the lower-grade tobaccos produced in the Vera Cruz and Tuxpan regions in the eastern part of Mexico.

Native cigarette and cigar factories are found in Mazatlan, Tepic, Santiago Ixquintla, and Compostela. One large tobacco factory at Mazatlan has 20 cigarette-making machines, having a capacity of 60,000 cigarettes each per day, or a total daily production of 1,200,000 cigarettes. The products of the West Coast cigarette factories are sold up and down the coast and to Lower California.

Tobacco is not exported from Nayarit to the United States on account of the high prices paid for the product by the Mexico City factories and also because of the high American import tariff rate.

## RICE.

Two regions of the West Coast are important rice-growing centers—the Yaqui Valley and various sections in Nayarit, principally in La Labor, Navarette, Ixtapa, and Amatlan. In both areas the production is very abundant and of excellent quality, the Yaqui Valley having had a surplus above the needs of the domestic market in the 1921–22 season.

The 1921–22 production of rice in Nayarit was estimated at 18,000,000 kilos (about 39,683,200 pounds), valued at 1,701,000 pesos. The loss in cleaning in Nayarit is 37 per cent.

Mexico is a large producer of rice. The area under cultivation in this product in 1914 was estimated at 41,000 acres, producing 33,921,000 pounds, and the country exported that year a total of 1,451,000 pounds to Cuba and the West Indies.

In 1921 the Yaqui Valley had a total of 10,460 acres planted in rice, the production of which exceeded the domestic demand on the West Coast—causing the acreage planted to this crop to be decreased by 45 per cent in 1922, when the actual acreage devoted to rice was reported to be 2,861 hectares, or 7,090 acres.

Figures obtained on the production of a tract of 125 acres, for which exact records were kept, are as follows: 41,970 kilos, or 92,528 pounds, of head rice, the very highest grade of rice; 11,650 kilos, or 25,684 pounds, of No. 1 rice, or second grade; 11,750 kilos, or 25,904 pounds, of broken rice, or screenings, graded as No. 3 rice—the total being 144,116 pounds for the tract of 125 acres. This gives (at the basic rate of 1,144 pounds per acre) a total average annual production, for the Yaqui Valley, of 6,455 tons of rice of all grades, of

which the two lower grades form about 20 per cent in volume. The above figures do not include the by-products of "polish" and bran. The average production in the Yaqui Valley is 1.3 long tons of "paddy" rice per acre, and the loss in milling, cleaning, etc., is generally estimated to be about 20 per cent of the gross paddy-rice yield.

The "head" rice sells readily in Sonora, Chihuahua, the West Coast, and Lower California, but the No. 1 and broken-grain grades can not be disposed of readily in the Mexican markets, as even the very poorest class of people seem to prefer and demand perfect-grain rice even at a higher price. The broken-grain product formerly went to the breweries of central Mexico, but these plants can now obtain all the barley malt they want since the war, and the only recent offer for the No. 3 grade was at 5½ cents, United States currency, per kilo, delivered at Juarez, the freight and handling charges from the Yaqui Valley to Ciudad Juarez amounting to about 2 cents per pound alone. Sacks cost from 30 to 40 cents, United States currency, each, and are usually not returned. In July, 1922, it was estimated that there was a surplus in the Yaqui Valley of 1,170 tons of low-grade rice still on hand and not disposed of, for which no outlet could be found, thus representing a loss of 18.2 per cent of the total gross yield of the rice fields of the Yaqui Valley, 90 per cent of which is produced by American farmers. At the same time there was estimated to be still on hand in the valley about 22 tons of No. 1 rice, also unsold.

Planting is done in July and the harvest is during October, November, and December, with the month of November the peak of the harvest season.

The products of the West Coast, such as rice, can not compete with similar products grown in the United States, although they can be more cheaply produced, as a rule, on the West Coast of Mexico. The United States produced very large crops of rice during the past two years and also had a large surplus on hand which has only recently been disposed of.

The Chinese merchants of Sonora are the heaviest buyers of Yaqui Valley rice, which they send to the cotton-growing colonists in the Mexicali Valley in Lower California. In 1919 these people handled 20,000 sacks (of 110 pounds each) of the 1919 rice crop.

In March, 1922, the Mexican Government removed its embargo on the exportation of rice and suspended the export duty at the solicitation of the Yaqui Valley rice growers, who expected to be able to market their surplus crop in the United States at that time.

The American rice growers of the valley have a cooperative rice-cleaning mill at Cajeme in the Yaqui Valley, this mill handling 75 per cent of the crop grown in 1921. The same association plans to install a flour mill, but its erection has been suspended on account of present conditions of general market depression throughout the country.

## WHEAT.

### PRODUCTION IN SONORA AND NAYARIT.

For many years the State of Sonora has been a producer of wheat, although in some years, because of inadequate rainfall and the occurrence of frosts, the production has not been sufficient to meet

local demands and flour has had to be imported from the United States. According to the official records the State produced 19,607,740 kilos of wheat in 1905, the crop that year being valued at 1,133,759 pesos. Prior to 1910 the large flour mill at Hermosillo purchased about 225,000 bushels of Sonora-grown wheat at prices ranging from $1 to $1.25 United States currency per bushel. At that time the industry was heavily protected by a Mexican import tariff of 8 pesos per 100 kilos, or about $1.10, United States currency, per bushel. The average yield was estimated to be about 20 bushels per acre of seed planted.

Sinaloa also produced a small amount of wheat, given in 1905 as 822,700 kilos, valued at 41,649 pesos. Small quantities are still planted in the northern part of the State.

Wheat is also grown on a very small scale in several of the higher interior valleys of Nayarit around San Pedro Lagunillas and Santa Maria del Oro, but only for local consumption in the form of "tortillas," as there is no flour mill in the State and transportation is lacking for an outlet to other markets.

In 1922 Sonora had the largest crop of wheat in its entire history. Acreage in wheat had been greatly increased in the Yaqui Valley over 1921 on account of the surplus of the rice production the preceding year (a considerable quantity of which still remained unsold), growers being consequently attracted by the possibilities of a good wheat market in 1922. Reports show that the 1921 crop was insufficient for the needs of the State and that American flour had to be imported during April and May, 1922, 18 carloads of flour being sent to Hermosillo, as well as 40 carloads of American wheat for the mill there to help out the local shortage. According to the figures obtained by "La Hermosillense" mill at Hermosillo—the largest flour mill on the West Coast of Mexico—the crop harvested in June and July of 1922 would amount to approximately 300,000 sacks of 100 kilos each (1 kilo = 2.2046 pounds), distributed in the following manner:

| | Sacks. |
|---|---|
| Yaqui River Valley, canal irrigation | 140,000 |
| Rio Sonora, "bolsa" system of irrigation | 40,000 |
| Hermosillo region, "bolsa" system of irrigation | 50,000 |
| Mayo Valley, canal and "bolsa" system of irrigation | 75,000 |

The mill in question had on hand in August, 1922, a total of 130,000 sacks, with 30,000 more sacks expected—50,000 in excess of the storage capacity of this plant. This mill has a milling capacity of 200 "cargas" (of 300 pounds each) of flour per 24 hours of operation.

### FLOUR MILLS.

There are some 60 small hand mills in Sonora. The only large custom mills other than "La Hermosillense" are "La Palma" mill at Villa Seris, near Hermosillo, with a capacity of 40 "cargas" of flour per day; the new 30-"carga" mill recently erected at Magdalena, to the north; and the mill at Navojoa, with a capacity of 30 "cargas" of flour per day, owned and operated by the Mayo Valley Farmers' Association.

### IMPORT DUTY ON WHEAT.

After being suspended, a recent decree places an import duty of 0.04 peso per kilo on wheat imported into Mexico, in protection of the

native industry. This import tariff makes competition by American-grown wheat impossible as long as the native supply is sufficient for the needs of the West Coast.

Other estimates of the wheat crop of Sonora in 1922 placed the total at only 127,000 sacks of 100 kilos each, as in August most of the Yaqui Valley crop was said to have been moved, the figures being between 75,000 and 80,000 sacks, instead of the 140,000 sacks estimated for that region by the Hermosillo mill people a month earlier. The wheat production of the Mayo Valley was also reduced to 25,000 sacks, as compared with 75,000 sacks in the previous estimate, and the Rio Sonora and Hermosillo regions were placed as low as 22,000 sacks in the later estimate. However, there were reasons to believe that wheat was being held in both the Mayo and Yaqui Valleys for later shipment to the interior of Mexico via Manzanillo and the new port of Yavaros, now connected with Navojoa by the new railway, and that accurate reports of actual production were not being given out by the growers in order to influence prices in a favorable manner on account of the good wheat crops in other regions of Mexico, principally in Guanajuato and Jalisco, this same year. At the same time, the State of Arizona had on hand a large overproduction of wheat, and a market for this supply was being sought down the West Coast of Mexico, as it could not be shipped to the Middle West or East of the United States in competition with the wheat production of the rest of the country.

In 1922 the wheat crop of the northern part of Sonora was damaged to the extent of 40 per cent loss by heavy late frosts, principally in the Magdalena region and north of Hermosillo in the Sonora River Valley. Wheat is planted in Sonora from October to December and harvesting is done between May and the end of June.

#### MILLING SYSTEM.

The flour mills of Sonora are all operated on the "tercio," or custom-mill, system, whereby the mill receives the wheat from the growers or dealers and mills it into flour at the rate of 211 kilos 17 grams of raw wheat for 136 kilos 140 grams (300 pounds) of flour. The flour is then marketed by the grower or through brokers or dealers, with the mills also acting as distributers of this product.

#### IMPORTS OF CEREALS.

A consular report dated in June, 1922, showed that while the State of Sonora should be able to produce sufficient grains and foodstuffs for its domestic needs, large amounts of American products continued to be brought into the country, amounting to $56,943 per month, with the principal items as follows:

| | |
|---|---|
| Corn, average 4,306 bushels | $3,617 |
| Wheat, average 7,815 bushels | 13,312 |
| Wheat flour, average 4,812 barrels | 38,127 |
| Bread, biscuits, etc., average 5,862 pounds | 843 |

#### IMPORTS OF FLOUR AT MAZATLAN.

The brands of flour imported at Mazatlan are not many in number, and, as a rule, the cheaper grades have been the most popular in this section, although small quantities of a better grade have been increasing in demand during recent months, principally for mixing

with the domestic flour milled in Sonora. Five years ago flour constituted the largest item of importation into the port of Mazatlan by water from the United States (San Francisco), but since then the increased production in Sonora and Jalisco has been sufficient to meet local needs and imports of American flour have decreased. However, there still remains a market in Mazatlan for American flour, despite the new import duty of 0.08 peso per kilo.

#### PROBLEM OF MARKETING SURPLUS WHEAT PRODUCTION.

As with the rice production of Sonora, the marketing consideration seems to be the paramount one in the case of wheat, and production can not be consistently increased until means have been found to provide an export market for surplus production over and above local domestic needs of the West Coast, especially as the central States of Mexico normally produce sufficient wheat to supply the flour needs of the bulk of the population in the more densely inhabited portion of the country.

### GARBANZOS.

The State of Sonora is the world's largest producer of "garbanzos," or chick-peas, the bulk of its production going to Spain and a large portion to the West Indies, where garbanzos have become, as in Spain, a staple article of diet for the people. Production has increased enormously since 1905, when 65,142 hectoliters were produced, valued at 550,738 pesos (1 hectoliter = 2.8378 bushels). That same year northern Sinaloa produced a total of 3,588 hectoliters, valued at 22,325 pesos. The garbanzo-growing regions are confined to the Yaqui Valley, the Mayo Valley, and the Sinaloa River Valley, with the Mayo Valley the chief producer. The Mexican Government statistics for the calendar year 1918 place the total production of garbanzos at 69,303,650 kilos (1 kilo = 2.2046 pounds).

#### CULTIVATION AND MARKETING.

"Garbanzos" are most successfully grown in the State of Sonora on the alluvial plains near the mouths of the Mayo and Yaqui Rivers, where the altitude is but little above sea level, although they are also grown farther inland at altitudes around 300 feet, with more or less success. The plant is very tender and subject to injury by frost. During the growing season the temperature ranges from 70° F. to the freezing point. At planting time in October it ranges from 50 to 90° F.

The average rainfall in the garbanzo region in the Yaqui Valley is 9 inches and in the Mayo Valley 13 inches. No rain falls during the growing season of this crop, and the growers depend entirely upon irrigation, as the rains begin in July and end in October, just before the first planting begins. The method of irrigation of the garbanzo fields most commonly employed is the "bolsa," or "basin," system, the fields having a border and being flooded in August and September with water from the ditches or freshets. When the "bolsas" have dried sufficiently, plowing, harrowing, and planting are done. In the majority of the fields no irrigating is done during the growing season of the plant, the moisture retained by the soil being usually sufficient to mature the crop. In the Yaqui Valley where abundant water is

always available, some irrigating is done from the supply ditches during the growing season. The normal yield per acre is from 20 to 35 bushels.

The exact time of planting depends upon the arrival of the flood waters in the Mayo Valley, where all the water for the irrigation ditches is taken from the river by gravity, but most of the crop is planted in October.

The garbanzos are harvested in May, when the plants are pulled up by hand in the field and turned over so as to enable them to dry thoroughly. They are then carried in bunches to central points in the field where a threshing floor has been made on beaten ground. The harvest workmen are paid at the rate of $1 per sack of 220 pounds.

The pre-war prices obtained by producers of garbanzos averaged about $10 per sack of 220 pounds. The present prices range from $11 to $14 per sack, delivered at railway cars. Part of the 1919 crop was badly spoiled by heavy rains and sold for as low as $7 per sack. There are no distributing markets for garbanzos in Mexico, practically all of the crop being shipped by rail to Guaymas for export to Spain and the West Indies, or by railway to Nogales and thence to New Orleans for export to Europe and the West Indies. At Guaymas and Nogales the peas are fumigated, regraded, and sacked for export. The offices of the more important buyers and distributers are in New York, New Orleans, Habana, Porto Rico, and Spanish ports. The purchasing houses usually have the agents on the ground before and during the harvest, when contracts are entered into for the sale and delivery of the crop. In many cases advances at high rates of interest are made on the crop to growers with limited capital.

During the war a serious scarcity of sacks prevailed in Sonora and Sinaloa, owing to British embargoes, with the result that some peas were shipped to the American border loose in box cars and were there packed in any kind of sacks available. In former years the garbanzos were graded in machines in the fields and at Guaymas before shipment by water, but very few garbanzos are graded now, since the buyers prefer them as they come from the fields. The grains run usually from 40 to 60 to the ounce and sell accordingly, being graded at destination or at transshipment points.

Following is a report submitted by American Consul B. F. Yost under date of April 17, 1919:

Although large quantities of peas are threshed by means of hand flails or are tramped out on the threshing floors, a few years ago threshing machinery was introduced, along with grading and cleaning machines. As the average farmer can not afford to purchase agricultural implements, sometimes groups of farmers club together, sharing the expense of purchasing and operating, although occasionally this is done by the buyers of the crop. It is thought that when the political and economic conditions are more settled there will be increased demands for plows, harrows, seeders, and other articles in general use, not only on the garbanzo farms but on other farms as well. Probably the best way to reach this market would be through implement dealers in Guaymas or Navojoa.

It is estimated that there are at least 25 garbanzo cleaning and grading machines in the district which have not been in use since 1913, and in which about $50,000 has been invested. Ten of the machines are standing idle at Guaymas and another 10 in the Mayo Valley. That they are no longer used is attributed to the fact that the purchasers prefer to buy the product threshed in the old way, and under the circumstances there are no openings here for the sale of this kind of machinery.

Ordinarily the garbanzos are packed in 100-kilo jute sacks; but owing to the British embargo on all jute there has been a great scarcity of bagging during the past two years, so that some of last year's crop was shipped loose in the cars, while some was packed in

any kind of sacks obtainable. Ordinarily the sacks are 44 by 26 inches in size, hold 220 pounds, weigh 2½ to 3 pounds, and cost at present about 60 cents apiece wholesale. The duty amounts to 10 to 14 cents apiece, depending on the weight and weave. The same class of bags is also used for transporting beans, corn, wheat, and other farm products. Flour sacks in general use here are white cotton, 36 by 26 inches in size, and holding 150 pounds of flour. At present very few ore sacks are used in this district, as the products of the mines are shipped either as ore or bullion and seldom in the shape of concentrates.

The rice sacks are of white cotton material, 38 by 18 inches, and hold 100 pounds. The cooperative rice association in the Yaqui Valley orders its sacks directly from exporters in the United States, chiefly from San Francisco. In normal times practically all sacks for the shipment of garbanzos are furnished by the New York brokers, whose purchasing representatives are here on the ground as the harvest approaches. Nearly all local general merchants also deal in sacks of various kinds.

Practically the whole output of garbanzos of Sonora is purchased by firms in Porto Rico, Cuba, and Spain, in normal times being loaded on board ship at Yavaros and Tobari in small vessels bound for Guaymas and Topolobampo, whence they were shipped direct. However, since the great scarcity of cargo space caused by the war, shipments have been chiefly by rail over the Southern Pacific of Mexico to Nogales, thence via El Paso to New Orleans and New York, where they are loaded on board ship and sent to their respective destinations.

Owing to the excessive freight rates across the Atlantic, the Spanish markets have been but little depended upon, and the bulk of the crop was consumed by Cuba and Porto Rico, with limited quantities purchased by the United States and South America. Prices last year (1918) were very high and the farmers obtained highly satisfactory results.

The following are the freight rates in carload lots, per 100 pounds: From Guamuchil (Sinaloa) to New York, $1.15½; to Galveston, $1; to New Orleans, $1.03; from San Blas (Sinaloa) and Navojoa and Esperanza (Sonora) to New York, $1.06½; to Galveston, $0.94; to New Orleans, $0.94.

The shipment and marketing of the 1918 crop was handled entirely by the Garbanzo Growers' Association (Unión Garbanzera) through a well-known financier and business man residing at Nogales, Sonora. Previously, the custom had been for buyers to come in person or by representative to contract for the growing crops, on advance payments of one-half the value of the estimated crop, with a provision for deducting $1 from the current price as interest for the use of the money advanced.

The garbanzo movements, according to railway statistics, reflect the situation brought about by the Yaqui Indian disturbances. While the farmers in the Yaqui Valley adjacent to Esperanza and Cajeme were able to raise crops, those located farther down the river and in the outlying districts in this section were exposed to Yaqui raids and consequently did not endeavor to cultivate their lands or produce crops.

A report in August, 1922, stated that the 1922 crop would be 25 per cent below the average for previous years on account of frost damage and the ravages of various insect pests that had recently invaded the fields.

### EXPORTS OF GARBANZOS.

According to data compiled by the Southern Pacific Railroad of Mexico (Guaymas office) the 1920 crop of garbanzos in Sonora was much greater than those of either 1918 or 1919. The following table shows the movement of this product from the several railway stations for 1920, as compared with 1918 and 1919, quantities being expressed in bags of 220 pounds each:

| Railway stations. | 1918 | 1919 | 1920 |
|---|---|---|---|
| | *Bags.* | *Bags.* | *Bags.* |
| Navojoa | 118,710 | 134,457 | 168,743 |
| Sacarachi | 23,033 | 22,719 | 31,336 |
| Cajeme | 9,384 | 5,793 | 26,457 |
| Esperanza | 15,534 | 14,551 | 22,706 |
| Fundicion | 608 | 2,948 | 2,825 |
| Other stations | 7,594 | 2,674 | 4,520 |
| Total | 174,863 | 183,142 | 256,587 |

All the above peas were shipped by rail to Nogales, with the exception of about 8,000 bags which went to San Pedro, Calif., from Guaymas by water and thence to Spain. Those shipped to Nogales were later sent to New Orleans or Gulf ports for shipment to New York and Europe.

In January and February, 1920, late frosts and extremely heavy spring rains damaged the garbanzo crop in the Mayo Valley by 30 per cent.

In 1917, 1918, and 1919 prices for garbanzos for Spain and the West Indies averaged as high as $14 per sack of 220 pounds, and the industry was a very profitable one even with ocean tonnage hard to secure for direct water shipment from Guaymas and the traffic diverted to New Orleans with a long rail haul. In 1920 prices slumped to $7 per sack, on account of the lack of demand from Spain, and again in 1912 to as low as $6 per sack. In an endeavor to stabilize the industry and come to the assistance of the growers, the Mexican Central Government, through the Comisión Monetaria, extended loans of $5 per sack to the growers and held the grain as security. The interest rate was at first 18 per cent per annum, but was later reduced to 12 per cent.

#### GRADING.

The standard-grade size for garbanzos is 54 to the ounce. The grading is done by means of sizers (sieves).

#### EMBARGO AGAINST EXPORTATION.

In August, 1921, it was reported that the embargo against the exportation of garbanzos which the Mexican Government had maintained for some time in order to affect prices favorably for this product was to be removed in October of that year. The 1921 crop was moving in August at prices averaging 6¾ cents per pound, f. o. b. cars. The freight rate from Navojoa to New York was $1.05 per hundredweight.

In March, 1922, another embargo against the exportation of this product was removed by the Mexican Government, the remainder of the 1920–21 crop having been disposed of, the final shipment being made by water direct to Spain in a Spanish steamer from Guaymas in August, 1922. One hundred and five thousand sacks were sold to a Cuban firm by the Comisión Monetaria, holding most of the old crop on loans made to the growers, as stated above.

#### GROWERS' ASSOCIATION.

In 1920 the growers in the Yaqui and Mayo Valleys formed an association, with headquarters at Navojoa, for the purpose of cooperative marketing of their crops, it being hoped to pool the crops and influence prices as much as an additional $5 per sack. On account of the market depression and heavy loans made by the Comisión Monetaria on the crops, the efforts of this association have not been very successful to date.

#### STERILIZATION PLANT AT GUAYMAS.

In July, 1921, the Mexican Central Government completed a garbanzo sterilization plant at Guaymas, Sonora, for the heat treatment of this product. About 100,000 sacks were treated by this

method that year, it being necessary to protect the grain from weevils and other insects that damage it in storage. The consensus among the growers was to the effect that while the heat process was as effective as fumigation, the cost made it impractical on account of the extra charges for additional handling, the cost reaching 24 cents United States currency per sack, whereas fumigation in a large warehouse does not exceed 8 cents per sack.

This plant was erected by the Government at a cost of about $50,000 United States currency and has a capacity of 30,000 to 40,000 sacks per day. The plant was erected by an American firm which specializes in this type of equipment. It is not now in operation.

### LABOR CONDITIONS IN MAYO VALLEY.

The labor situation in the Mayo Valley is very favorable to agriculturists. About 75 per cent of the farm workers are Mayo Indians, and the rest are Mexicans of the "peon" type. As a rule all work is carried out under the ancient "tarea" or task system, called "piecework" in the United States, the average daily wage amounting to about $1 per day at the present time. When on the piecework basis the men start at about 7 a. m. and finish about 3 p. m. Most of the men in the Mayo Valley own small farms of their own on which they grow small amounts of corn and beans for their staple foods.

### CLEANING MACHINERY.

American manufacturers have spent a great deal of time and money in the development of a garbanzo cleaning and sorting machine which they have been trying to sell to the growers for the past two years, but the growers do not seem to be interested and prefer to dispose of their product ungraded.

### SUMMARY OF GARBANZO CROP AND MARKET CONDITIONS IN 1922.

The marketing of the garbanzo crops of Sonora and Sinaloa is now practically controlled by the Sindicato de Cosecheros de Garbanzos de Sonora y Sinaloa, a growers' union formed in January, 1922. At the beginning of 1922 the whole of the 1921 crop was still being held in storage because of low prices and the continuation of the export embargo by the Mexican Government. The 1920 crop was nearly all sold by the beginning of 1922.

The Comisión Monetaria, the financial agency of the Government, holds considerable quantities of garbanzos in warehouse at Navojoa and Nogales, on which it has advanced loans of $5 per sack to the growers. It is believed that many of these loans will never be paid, because of the insolvency of the growers in many cases. There were about 100,000 sacks stored in warehouses at the port of Guaymas in January, 1922, many of which belonged to the Comisión Monetaria, and which it was planned to ship direct by steamer through the Canal to Spain. A Dutch line made an offer of $12 per metric ton as an ocean freight rate from Guaymas to Spanish ports early in the year, the lowest previous offer having been from the Compagnie Française of $15 per ton. Water rates to New Orleans had not been quoted at that date.

It was the desire of the growers to place from 100,000 to 125,000 sacks with Spanish dealers, the remainder—consisting of 100,000

sacks—to go to Cuba, Porto Rico, and other markets. An arrangement was being sought with an American firm to handle the market in the United States. The growers' union was then holding out for a flat price of $10 per sack, f. o. b. shipping point on the West Coast. Freight rates per hundredweight over the Southern Pacific of Mexico to New Orleans were quoted as follows:

| From— | |
|---|---|
| Guaymas, Sonora | $0.85 |
| Navojoa, Sonora | 1.05 |
| San Blas, Sinaloa | 1.05 |
| Naranjo, Sinaloa | 1.075 |
| Bamoa, Sinaloa | 1.085 |
| Guamuchil, Sinaloa | 1.085 |
| Caimanero, Sinaloa | 1.14 |
| Culiacan, Sinaloa | 1.16 |

It is understood that garbanzos stored at Guaymas are entitled to the through rate from points of origin—that is, they will not be charged for local freight to Guaymas.

In March, 1922, the Southern Pacific reported a movement of 152,819 sacks, with 6,800 sacks still in storage in the Government (Comisión Monetaria) warehouse at Navojoa. The crop of 1921 amounted to about 230,000 sacks.

In August, 1922, the embargo was removed on the exportation of the 1921 crop but was still in force on the 1922 crop, for the purpose of holding up prices by creating an artificial shortage in the European and West Indian market centers, and also to enable the growers to dispose of the old stocks still held from the previous year.

The firm of E. Fernandez, Alonzo, y Cía. (Spaniards) controls the stocks held by the Comisión Monetaria, and also controls the selling agency in the American and West Indian markets through its New Orleans office. In April, 1922, this firm took a total of 115,000 sacks on a 75-day delivery contract. Forty thousand sacks were sold to a Spanish firm of Bilbao, Spain, at a price of $8.85 f. o. b. Guaymas. It is not thought that more than 10,000 sacks are still being held by independent growers.

The crop for 1922 was estimated at 30,000 sacks less than for 1921 on account of heavy frosts in early spring; 175,000 sacks was estimated as the total crop for the 1922 harvest.

Prices in New Orleans were said to be $18.75 per sack, duty unpaid, with sizes running from 48 to 54 to the ounce. This same offer was reported as having been made to Cuban and Porto Rican importers. In June, 1922, a Spanish steamer loaded 65,000 sacks at Guaymas for Bilbao, Spain (6,000 tons load). Thirty thousand sacks moved by rail to New Orleans in May, 1922, being the last of the 1921 crop.

### EFFECT OF WAR ON MARKET.

The war presented obstacles to the garbanzo trade in the way of scarcity of ocean tonnage and lower prices following the market slump all over the world in 1920.

The production of garbanzos in Spain in 1920 amounted to 1,399,351 metric "quintals" on an area of 226,940 hectares. The total shipments from Sonora to Spain during the same year reached approximately 431,000 sacks of 220 pounds each.

According to the report of the Mexican consul general at Barcelona, imports of garbanzos from Mexico at that port since 1913 have been as follows:

| Years. | Kilos. | Value in pesetas. | Years. | Kilos. | Value in pesetas. |
|---|---|---|---|---|---|
| 1913 | 8,941,049 | 4,828,166 | 1917 | 1,292,148 | 649,159 |
| 1914 | 10,114,044 | 5,461,593 | 1918 | 205,543 | 111,127 |
| 1915 | 4,097,496 | 2,212,547 | 1919 | 7,361,200 | 3,975,070 |
| 1916 | 4,574,943 | 2,470,469 | 1920[1] | 7,420,467 | 4,007,852 |

[1] Up to the month of September, 1920.

## SUGAR.

Sugar has been characterized as the preeminent industry of the West Coast of Mexico. The production exceeds in value that of any other one industry of this region, the sugar-cane lands of Sinaloa and Nayarit being classed among the best in Mexico, Cuba, or South America.

### PRODUCTION FIGURES—NUMBER OF MILLS.

The production of sugar in Mexico during 1908 was approximately 125,000 tons. The output, by record, from July 1, 1907, to July 1, 1908, was 123,285 metric tons, 70,947 metric tons of molasses, and 50,000 metric tons of the brown sugar of the country, called "panocha." In the past 90 years the world's consumption of sugar has increased by 900 per cent. Mexico's production of sugar between 1900 and 1908 increased by 60 per cent, and the consumption of refined sugar within the Republic increased faster than the world's consumption.

Sugar experts and engineers specializing in this industry estimate that sugar can be produced on the West Coast of Mexico for a gross cost of $0.01 per pound. Egyptian sugar costs $0.02⅓ to produce. In 1904 and 1905 Mexico sold in foreign markets sugar to the value of $6,000,000 United States currency. In 1905 the State of Sonora produced brown sugar ("panocha") to the value of 80,892 pesos, the quantity being given in official statistics for that year as 552,566 kilos, while the cane grown was valued at 1,047,065 pesos. In the same year the figures given for the State of Sinaloa were 10,039,000 kilos of sugar, valued at 1,260,750 pesos.

More recent official figures on the sugar production of Mexico, reproduced in the Revista de Hacienda, Mexico City, August 14, 1922, show the 1921–22 sugar crop of the country and details of production by States, as follows:

| States. | Number of mills. | Production in metric tons. | States. | Number of mills. | Production in metric tons. |
|---|---|---|---|---|---|
| Vera Cruz | 21 | 50,000 | Tabasco | 11 | 4,000 |
| Sinaloa | 7 | 24,000 | Colima | 3 | 1,700 |
| Puebla | 6 | 10,000 | San Luis Potosi | 1 | 1,500 |
| Michoacan | 15 | 10,000 | Yucatan | 1 | 500 |
| Jalisco | 16 | 7,000 | | | |
| Nayarit | 2 | 6,000 | Total | 92 | 119,800 |
| Oaxaca | 9 | 5,000 | | | |

Some of the mills ground only part of the season, and four were shut down the entire season. The above figures were arranged by the Câmara de Productores de Azucar, of Mexico, the central national organization of sugar producers in Mexico. The mills cited above are those turning out refined sugar, and the figures do not take into

account the enormous production of native brown sugar, called "panocha," by many thousands of small plants all over the country.

### SURVEY OF INDUSTRY.

The "Aurora" plant of Redo y Cía. at Culiacan is the oldest sugar mill on the West Coast of Mexico. The cane is grown entirely on the light silt soil of the river bottom and produces 40 to 50 tons of cane to the hectare, with a mill production of about 100 kilos of white, refined sugar per metric ton of cane (1 hectare = 2.47 acres; 1 kilo = 2.2046 pounds).

The "El Dorado" plantation, also of Redo y Cía., on the San Lorenzo River just below Culiacan, produces from 60 to 80 tons of cane to the hectare and from 65 to 75 kilos of refined sugar per metric ton of cane. Soil conditions are somewhat similar, but there is more clay content in the soil of the sugar lands of the San Lorenzo Valley.

At the Los Mochis plantation of the United Sugar Co. the clay base soil produces 50 tons of cane to the hectare, as against 60 tons produced by the sandy, alluvial soils around the "Aguila" division of the lands of this company in the Fuerte River Valley. In comparing the two plantations of this company in the Fuerte Valley it may be noted that the cane from the clay soils produces 15 per cent more sucrose than the cane from the light, sandy soils at "Aguila." (For details of the Los Mochis plant of the United Sugar Co. in the Fuerte Valley, see p. 111.)

### ALMADA SUGAR REFINERIES CO.

The sugar lands of the Almada Sugar Refineries Co., S. A., which is entirely owned by Mexicans of Culiacan, Sinaloa, is located on the Culiacan River halfway between the capital and the coast at Altata, on the Occidental Railway, which now connects with the Southern Pacific of Mexico at Culiacan. This company was incorporated in New York in March, 1902. In 1908 more machinery was installed at a cost of $360,000 United States currency, doubling the capacity of the mill. Twice as much cane was also planted, giving the new plant a total capacity of 8,000,000 to 9,000,000 kilos of sugar and 1,200,000 liters of alcohol per annum. That year the plant and holdings were offered for sale to Americans at 5,000,000 pesos. An inventory of the property in 1909 showed values as follows:

| Items. | Mexican pesos. |
|---|---|
| Sugar factory; old valuation, 856,000 pesos, increased to | 1,216,000 |
| Alcohol and liquor factories | 400,000 |
| General offices, warehouses, etc | 25,000 |
| 5,860 acres planted, part to cane, all fenced and irrigated | 3,842,370 |
| 63,785 acres north of Navolato; valuation increased from 1,017,079 pesos to | 6,306,500 |
| Irrigation canal, with structures | 350,000 |
| Centrifugal pumps, three 24 inches and two 18 inches | 100,000 |
| Garden and orchard lands | 10,000 |
| Lumber for buildings | 35,000 |
| Implements | 25,000 |
| 600 horses and mules, and equipment | 36,000 |
| 90 cane wagons | 11,000 |
| Portable railway (10,000 meters) | 11,000 |
| Portable railway | 11,000 |
| Water rights from State | 300,000 |
| Pilot boat *Navolato* | 14,948 |
| Lots and houses in town of Navolato | 125,000 |
| Telephone lines | 2,500 |
| Total | 12,821,318 |

NOTE.—It will be noticed that the value of the land held was increased in 1908 and 1909 from 1,017,279 to 6,306,500 pesos. This increase in the valuation placed on these land holdings was due to the influx of American land buyers following the construction of the railroad down the coast that year, when an era of land speculation was induced by their activities.

### PRODUCTION DATA, NAVOLATO PLANTATION.

The following data on production and costs of cane products on the Navolato plantation of Almada y Cía. may be taken as average figures for the Fuerte, Culiacan, and San Lorenzo Valleys and the sugar lands in the State of Nayarit (values given are for a pre-war normal year):

Cane grown: 38,000 tons for the year.
Refined sugar: 2,200 metric tons.
Yield: 5.73 per cent, or 1 ton of sugar per each 17.45 tons of cane, metric measurement.
Cost of producing sugar, 4.55 centavos per pound.
Selling price of sugar, 9.15 centavos per pound.
Cost of producing alcohol, 11.38 centavos per liter.
Selling price of alcohol, 25.43 centavos per liter.

The high-grade white sugar is put up in loaves and cubes. The gray centrifugal sugar is of 96° to 97° polarization. The alcohol is 96 per cent.

The cane cutting and grinding season lasts from December to May. The mill operated an average of 140 days and nights for the season that year. Two thousand one hundred acres of cane were cut in 1909, and the property showed an annual interest return, net, of 11 per cent on a capital investment of 5,000,000 pesos. It was thought that production of refined sugar could be increased, with the same amount of cane, from 5.75 per cent to 8.5 per cent by means of a more modern plant and methods. Although no new mill has been installed since then, various improvements have been added to this plant during the prosperous years of high prices for sugar during the Great War, and cane acreage has also been materially increased.

### SUGAR INDUSTRY IN TEPIC, NAYARIT.

One of the industries in the State of Nayarit that has received the greatest impulse is that of sugar cane, the cultivation of which has been extended to the plantations ("haciendas") of Puga and La Esvondida (belonging to the Spanish house of Aguirre y Cía.), La Labor, Mojarres, La Fortuna, San José del Conde, and La Cofradia, and to various outlying municipalities where the native brown sugar called "panocha" is made.

There are three modern sugar factories turning out white refined sugar for local consumption, two of the largest belonging to the Spanish house of D. G. Aguirre, Sucs., of Tepic. The plant at Puga on the railway below Tepic has a total of 1,000 hectares in sugar cane, and that of La Escondida has 500 hectares in cane. Both plants turn out an annual production of 4,000,000 kilos of refined sugar and 15,000 cases of refined alcohol of 10 gallons each. The machinery of these two plants is very old and principally of French manufacture, although recent additions and replacements have been ordered from England.

The new modern plant of Manchaca y Cía., of Tepic, was erected early in 1922 to take the place of an old native "panocha" plant on the property, which is located about 15 miles south of the city of Tepic. Four hundred hectares are planted in cane. Two hundred thousand kilos of refined white cube sugar were produced in the 1922 season, and the plant is expected to produce 500,000 kilos in 1923. From 3,000 to 4,000 cases (of 10 gallons each) of refined alcohol are

produced with the present equipment, which is most modern and up to date.

"La Labor" Hacienda, 25 miles east of Tepic, contains 170,000 hectares of lands, with a large area in sugar cane, which is all turned into alcohol, some 20,000 cases (of 10 gallons each) being produced annually. This hacienda is owned by Sr. Gongoita, a Spaniard.

#### MARKET FOR ALCOHOL.

In the State of Jalisco there are very large plantations of the blue mescal plant, a species of the agave, from which the native liquor, called "mescal" or "tequila," is made, being distilled from the head of the plant at its maturity every seven years. The largest of these mescal plantations is located at the town of Tequila, in Jalisco, near the line with the State of Nayarit and on the San Marcos Branch of railway from Guadalajara. Investigation in Tepic in September, 1922, showed that these mescal plants were the principal consumers of Nayarit and Sinaloa alcohol production, the product being used for the making of certain brands of "tequila" (or "mescal") for consumption in all parts of Mexico, this being the common native drink and very intoxicating. The use of raw alcohol for the adulteration of the "mescal" liquor has been increasing enormously in Mexico during the past few years, as alcohol can be produced more cheaply and rapidly in the modern sugar plants from the cane refuse and molasses than the liquor itself can be produced from the slow-growing species of agave plant (which also yields the "ixtle" fiber, similar to the henequen fiber of Yucatan). All the sugar plants are equipped with alcohol-distilling plants and also have their own can-making machinery where they make the standard 5-gallon tins such as are used for shipments of case oil products.

The two plantations of Aguirre Sucs. in Nayarit are located in rough, hilly lands, where plowing is done on hillsides, but they have abundant water for irrigation of the cane. All the other plantations of the West Coast are located nearer the mouths of the river valleys and are on level alluvial lands.

#### PROTECTIVE TARIFF ON SUGAR.

In February, 1922, the Mexican Government placed a protective tariff on imports of sugar into Mexico, in protection of the native industry. The rate is 15 centavos (0.15 peso) per kilo on refined sugar imported into Mexico. The rate is sufficiently high to exclude Cuban and other sugars from the Mexican market, having been increased from 0.10 peso.

#### MARKETS FOR WEST COAST SUGAR.

The planters of the West Coast have formed a marketing association and sell most of their product—above local demands—in the central and northern parts of Mexico, usually shipping by rail via Nogales and Ciudad Juarez. On account of the credit situation that followed the slump in the sugar market in the fall of 1920, stocks are now held in warehouses at El Paso, on the American side, so that loans can be secured on these stocks until the product can be distributed to the consumers in the interior. Banks in Mexico will not loan money on stocks carried in that country, on account of the

uncertainty of the political and economic situation in that country. Redo y Cía. and the United Sugar Co. of Los Mochis maintain offices in Los Angeles, Calif., and do a good deal of their financing through that center since the revolutionary times in Mexico. Sales offices are maintained in Mazatlan and in El Paso, Tex.

### PRESENT CONDITION OF SUGAR INDUSTRY.

The prices being obtained for sugar in Mexico are higher than those obtained for the same product in the United States because of the protective tariff and its exclusion of foreign sugars. At the beginning of the European War the sugar producers of the West Coast, as elsewhere in Mexico, were heavily in debt for their equipment, plantation improvements, etc., but the extraordinarily high prices obtained during the war years for their product, despite local revolutionary conditions, enabled them to pay off their indebtedness, and they now face a very prosperous condition even in view of prices lower than those during the war years. The El Dorado plant of Redo y Cía. on the San Lorenzo River below Culiacan, has been greatly enlarged and improved recently and now ranks about equal in equipment and production to that of the United Sugar Co. at Los Mochis in the Fuerte Valley.

## TOMATO AND WINTER-VEGETABLE INDUSTRY.

The winter tomato industry of the West Coast of Mexico was started about 15 years ago by the American colonists at Los Mochis in the Fuerte Valley, and since then this industry has rapidly increased, its development having overshadowed all other activity on the West Coast during the last three or four years. On account of the lack of markets for other products of the region and the economic necessity of exporting some product to a foreign market, and also because of the large returns possible in this branch of agriculture, many native landowners have also been attracted to tomato growing and are investing heavily, while several millions of dollars of American capital, principally from California, have been recently invested, not only in winter tomatoes for the American market, but also in the production of early green vegetables such as green corn, string beans, chili peppers, okra, peas, etc., and also cantaloupes.

Five thousand crates of tomatoes were shipped in the early spring of 1908 by express and netted the growers about $0.80 per crate. Since then the development of this new industry has been phenomenal, as is shown by the following tables of actual shipments compiled by the railways for the season of 1921–22, with quantities expressed in carload lots:

PRODUCTION OF FUERTE VALLEY AND LOS MOCHIS COLONY.

| Classes. | Cars. |
|---|---|
| Tomatoes | 620 |
| Chilis | 33 |
| Vegetables | 15 |
| Cantaloupes | 14 |
| Total | 682 |

PRODUCTION FROM SINALOA, SOUTH OF THE FUERTE VALLEY, AND FROM NAYARIT.

| Stations. | River valleys. | Tomatoes. | Cantaloupes. | Vegetables. |
|---|---|---|---|---|
| | | *Cars.* | *Cars.* | *Cars.* |
| Bamoa | Sinaloa | | 17 | |
| Colorada | Culiacan | | 1 | 14 |
| Kilometer 541 | Mocorito | 15 | | |
| Culiacan | Culiacan | 90 | 4 | |
| La Cruz | Elota | 52 | 1 | |
| Modesto | Quelite | 62 | | |
| Presidio and La Noria | Presidio | 98 | 4 | 10 |
| Rosario | Rosario | 19 | | |
| Esquinapa | Rosario, etc | 16 | | |
| Morada and Ruiz | San Pedro and Santiago | 161 | 24 | |
| Total | | 513 | 51 | 24 |

TOTALS FOR SEASON OF 1921–22.

| Classes. | Cars. |
|---|---|
| Tomatoes | 1,113 |
| Chilis | 33 |
| Vegetables | 39 |
| Cantaloupes | 65 |
| Total | 1,250 |

ESTIMATED ACREAGE OF THE ABOVE CROP, SEASON OF 1921–22.

| Districts. | Tomatoes. | Cantaloupes. | Vegetables. | Chilis. |
|---|---|---|---|---|
| | *Acres.* | *Acres.* | *Acres.* | *Acres.* |
| Santiago, Nayarit | 200 | | | |
| Tuxpan, Nayarit | 1,000 | 500 | | |
| | 200 | 200 | | |
| Esquinapa, Nayarit | 200–250 | | | |
| Rosario, Sinaloa | 200 | | | |
| Villa Union, Sinaloa | 900 | | | |
| Modesto, Sinaloa | 475–500 | | | |
| La Cruz, Sinaloa | 500 | 35–40 | | |
| Culiacan, Sinaloa | 1,250 | 60 | 30 | |
| Colorada, Sinaloa | 250 | | | |
| Navolato, Sinaloa | 250 | | | |
| Limoncito, Sinaloa | 400 | | | |
| Fuerte Valley: | | | | |
| Constancia | 400 | | | |
| Teroque | 500 | 160 | | |
| Los Mochis | 2,925 | | | 85 |

The conference of tomato growers of the West Coast estimated the total tomato acreage planted in the 1921–22 season at 7,600 to 7,800 acres, but this estimate was later reduced to 5,500 available acres for actual picking by February, 1922, on account of the ravages to the crop by plant disease and insect pests experienced that year.

The acreage planted in tomatoes for export to the American markets in 1919 for the 1920 shipping season was 50 per cent greater than the area planted the preceding year. Trial shipments were made to Canada also.

### RENEWAL OF TOMATO INDUSTRY IN GUAYMAS VALLEY.

Under date of February 5, 1921, the American consul at Guaymas, Sonora, reported that tomato growing on a commercial scale had been renewed in the region just north of the port, where depredations of the Yaqui Indians had caused the industry to be suspended for several years. Important truck farms near Guaymas were being reha-

bilitated by Chinese farmers, who expected to be able to ship 8 or 10 carloads of tomatoes that season. (These lands belong to Sr. Luis A. Martinez, of Guaymas, Sonora.) Here irrigation is by means of shallow wells.

### DAMAGE BY FLOODS.

The spring equinoctial rains are, some years, sufficiently heavy to cause the streams to rise and cause damage by floods during the critical time of the tomato-growing season on the West Coast. In January, 1919, floods in the Fuerte Valley caused the loss of about 10 per cent of the tomato crop, the loss being estimated at from 40 to 50 carloads of 1,000 lugs each. Exceptionally heavy rains in the mountain region caused the streams to overflow and destroy a number of fields of tomatoes. High water in the early part of the season does not occur annually, but only in exceptional years.

### LOSS BY FROST.

Loss due to frost seldom occurs south of Los Mochis in the Fuerte Valley, where, every two or three years, heavy frosts are experienced that damage about 10 per cent of the tomato crop when it is about ready for the first picking. In the Culiacan Valley heavy rains and frosts in January, 1919, damaged the tomato crop to the extent of 15 per cent.

### TRANSPORTATION DIFFICULTIES IN 1920.

Revolutionary activities in 1920 and the taking over of the Southern Pacific of Mexico Railroad by the State authorities of Sonora that year during the tomato shipping season caused the Southern Pacific in the United States not to receive or deliver freight from or to its line in Mexico unless empty or loaded cars were received in exchange, and this condition, together with the strike of the railway workers in Mexico, caused the tomato growers to seek an outlet for their product by water transportation. One of the tomato-handling associations, the Mexico-Arizona Trading Co. (of Nogales, Ariz.), arranged to ship by steamer to Los Angeles, Calif., and the first boat took 40,000 lugs to San Pedro in April. The water trip took five days, and only a small part of the shipment could be refrigerated. This shipment brought up the total of the 1920 shipments above those of the preceding year.

### RESULTS OF 1921 TOMATO CROP.

Writing under date of December 1, 1921, the American consul at Nogales, Sonora, says of the results obtained by the growers:

The growing of winter vegetables in Sinaloa is an industry already measured in millions of dollars and promises to become one of the largest on the West Coast of Mexico.

The prospects for the tomato crop for 1922 are reported to be excellent. There is a considerable increase in the acreage being planted, the estimate for the 1922 shipping season being 8,546 acres, against 5,000 acres in 1921. During the 1921 season 923 carloads of tomatoes were shipped from Sinaloa to the United States, and if conditions are favorable a much larger number will be offered in 1922. Shipments will begin about the first of January and continue until June. Florida shipments begin about March 1, and those from California and Texas about May 1.

It was found last year that there was a shrinkage of about 10 per cent in tomato shipments after leaving Nogales, so a cooperative organization of tomato growers has decided to build a packing house in Nogales (Sonora) which will cost about $18,000 and employ 100 hands during the harvest season. Overripe tomatoes will be disposed of locally or shipped to near-by markets. A saving of 15 cents per box on the entire pack is anticipated through repacking.

Writing under date of July 13, 1921, the American consul at Mazatlan, Sinaloa, reported as follows on the experience of the tomato growers and shippers for the 1921 season:

Tomato growers in Sinaloa exported 923 carloads of tomatoes to the United States during the harvest season which began in January and ended the latter part of May. There was an average of about 825 lugs per carload, the crates averaging about 28 pounds each. There was, therefore, an average of about 23,300 pounds of tomatoes per carload, or a total of 455,900 pounds of tomatoes exported to the United States during the season just closed.

The average gross price per crate in the United States markets was $2.62. The cost of production, freight, etc., totaled about $1.83 per crate, giving a net profit per crate of $0.79 to the growers. On the basis of these figures, which have been carefully obtained from the best sources of information available on the subject, it is apparent that the total net profits realized on tomatoes exported to the United States during the season was $601,565.

Nearly all the tomatoes exported from the State of Sinaloa are marketed west of the Mississippi River, and for that reason, as well as because the harvest begins during the first days of January, this crop is not a serious competitor of the Florida product which is sold in the East, but it is quite impossible for Sinaloa tomato producers to export at a profit 10 days after the California and Texas crops begin to flow to the markets west of the Mississippi. When the harvest of these crops begins the Sinaloa producers are forced to discontinue operations, no matter what quantity or quality of tomatoes they may have on hand, as the freight and customs charges are so high and the selling price so low that they could operate only at a loss. The 94 carloads of Sinaloa tomatoes that were sold in Texas were marketed before the crop in that State matured.

### RESULTS OF 1922 TOMATO CROP.

On account of the highly speculative character of the tomato industry, not only from the market standpoint but also from that of the very possible losses through damages caused by plant disease and insect pests, it is considered desirable to give the yearly season experience of the tomato growers of the West Coast.

In 1921 the Florida growers, whose tomatoes reach the market centers of the United States in advance of those from either California or Texas, experienced heavy losses by late frosts, which materially reduced their shipments and made their crop poor in quality, although the Florida industry is much more highly developed and more scientifically handled than that of the West Coast of Mexico, where tomato and winter vegetable growing for the American market is comparatively a new industry. Because of the partial failure of the Florida crop, the growers of the West Coast of Mexico were able to ship to the United States as late as May and received extraordinarily high prices—at times as high as $4.25 per lug of 28 pounds—despite the poor quality of the Mexican product, which is watery and tends toward puffiness, wrinkling, etc. This success and high prices greatly stimulated interest in the 1922 production, when an enormous acreage—estimated at more than 8,000 acres—was planted in anticipation of another good season of high prices in 1922.

The Florida growers met with no reverse in 1922, and they enjoy the great advantages of a shorter rail haul to market than the producers in Mexico. Although the Mexican product reached the American markets, such as Kansas City, fully a month earlier than the first Florida shipments, the quality was so poor, because of the inherent structural defects of the Mexican tomato, the careless packing methods employed, the poor grading and selection, etc., that the Mexican tomato became discredited on the markets, so that

when the heavy Florida shipments started to reach these market centers prices were cut to such a low level that the Mexican shippers faced a serious loss.

The situation became so acute that one large cooperative association which handles a large share of the West Coast product made a survey of the conditions early in April of that year and decided, after having shipped about 100 carloads at a net loss of approximately $40,000, to stop shipping and let the remainder of the crop rot in the fields if the market did not show more strength later. Independent growers who packed carefully with well-selected fruit and shipped very early in the season reaped a handsome profit that season. It was thought that this experience with the 1922 crop would tend to curtail the acreage to be set out for the 1923 shipping season, but this was not the case. On the contrary, the 1923 acreage was in excess of that planted in 1922 by at least 60 per cent, and unless insect pests and plant disease again interfered with the crop production, the West Coast of Mexico was expected to ship the heaviest tomato crop in its entire history.

### FIGURES ON 1923 SHIPPING SEASON.

According to a report by American Consul W. E. Chapman, of Mazatlan, Sinaloa, dated January 18, 1923, the officials of the Southern Pacific Railroad of Mexico estimated that the tomato crop of the 1923 shipping season (January 1 to May 1, 1923) covered approximately 17,243 acres. Green peas covered approximately 2,320 additional acres on the West Coast in Sinaloa and Nayarit, but as this was the first season green peas have been planted to any extent in this region no estimate of the actual yield was ventured at that time. Mixed vegetables for the American markets covered an additional acreage of 1,559 acres, with cantaloupes planted on a total estimated area of 1,287 acres, bringing the total area devoted to tomatoes, green peas, other vegetables, including chilis, and cantaloupes on the West Coast for this season to 22,409 acres—all due to be shipped to the market points in the United States between January 1 and May 1, 1923. One car of tomatoes moved from Sinaloa to the United States as early as November 28, 1922, and several shipments were made in December, 1922, which is much earlier than shipments have been made in previous years.

The officials of the Southern Pacific Railroad of Mexico and the largest planters on the West Coast are agreed that tomato shipments to the United States from Sonora, Sinaloa, and Nayarit this season will total approximately 2,000 cars, averaging 800 crates or lugs per car, and that shipments of green vegetables will reach a total of 500 cars additional, or possibly more.

All crates and lugs used come from the United States and are of the customary American standard for each of the products shipped.

The demand for boxes and shooks for the West Coast of Mexico comes during the off season of the demand in the United States, and therefore constitutes a distinct advantage to the manufacturers of these products for packing.[19]

[19] For a discussion of the market on the West Coast of Mexico for wooden boxes, veneer boxes, and crates, the reader is referred to the report by Consul Chapman, dated Jan. 18, 1923. This report includes lists of tomato and vegetable planters of Sinaloa and Nayarit and also of the principal users of lugs and crates. Interested persons should address the Latin American Division, Bureau of Foreign and Domestic Commerce, Washington, D. C.

## SCIENTIFIC CONSIDERATIONS IN CONNECTION WITH WEST COAST TOMATOES.

There is reproduced below a report on the Mexican tomato situation by George K. Link, pathologist of the Office of Cotton, Truck, and Forage Crop Diseases, of the United States Department of Agriculture. This report gives a highly practical and scientific description of the West Coast tomato industry, the plant diseases and insect pests to which the plants are subjected in that region, and contains valuable recommendations for combating them. It also gives a history of the industry on the West Coast, with price and production data, discussion of proper packing methods, etc.:

Shortly after the inauguration of the inspection service of the Bureau of Markets in 1917 the attention of the United States Department of Agriculture was called to the Mexican tomato situation by the complaints of the receivers and carriers in Chicago concerning the condition and quality of Mexican tomatoes upon arrival. It was found that frequently 25 to 50 per cent of the fruit had to be discarded because of extreme softness, flabbiness, severe wrinkling, and, to a lesser degree, because of rots.

Mexican tomatoes are shipped into the markets of the United States from about January 15 to May 5, inclusive. During this period, Florida, Mexico, Cuba, the Bahama Islands, latterly the Canary Islands, and hothouses are the only sources of supply for tomatoes for the United States market, and consequently the tomato industry of Mexico has been expanding rapidly since its beginning 15 years ago. Its development, however, has been retarded, and it has not as yet established itself in its natural markets, which lie west of the Mississippi River, because a very high percentage of the Mexican fruit is of poor quality or in poor condition, or both, upon arrival in the United States.

Early in the winter of 1919 reports came from field men of the Bureau of Crop Estimates telling of the very extensive planting of tomatoes on the West Coast of Mexico. Shortly afterwards requests came with such insistence from receivers and carriers for authoritative information concerning the causes of the condition of the Mexican tomatoes upon arrival that the Department of Agriculture decided to send a representative into Mexico to make a brief survey of the tomato situation there. In making this decision the department acted on the conviction that a true diagnosis of the condition of a fresh food product at time of its arrival in the market can not be made without an understanding of field, cultural, harvesting, packing, and transportation conditions. The department was further influenced by the fact that the distributers and growers' organizations were eager to help, since they had become alarmed by the increasingly premature death of the tomato vines with attendant reduction of yield, and by the increased spotting of fruit in the field with the attendant heavy culling in the packing houses. The active and sympathetic cooperation of the shippers, growers, and the Southern Pacific Railroad of Mexico greatly facilitated gathering the field data presented in this paper.

This report is based on observation made of Mexican tomatoes in the markets in the United States during the shipping seasons of 1918, 1919, and 1920, and a brief but intensive study from March 6 to March 15, in the field, of packing and transportation conditions in the producing sections of the West Coast of Mexico. In addition, tomato shipments in transit were examined at Nogales, Sonora (31 cars), where all shipments are inspected before crossing the border; at Houston, Tex. (1 car), and at New Orleans, La. (2 cars).

### HISTORY OF THE WESTERN MEXICO TOMATO INDUSTRY.

The car-lot tomato industry of western Mexico has developed during the last 15 years. Prior to 1905 tomatoes were shipped from Mazatlan to Los Angeles and San Francisco by boat, but with poor success, since the steamers were not equipped with refrigeration facilities and were slow. Express shipments also were sent from Guaymas, in Sonora, and Los Mochis, in northern Sinaloa, through Nogales, Ariz., into the United States.

The first car-lot shipment was made from Bacum in the Yaqui Valley and Los Mochis in the Fuerte River Valley. The extension of the Southern Pacific Railway into southern Sinaloa between 1910 and 1914 made shipments from Mazatlan and other southern points possible.

Frosts destroyed the crop in the Yaqui Valley in 1910 and 1911, and since then the tomato industry has been restricted to the State of Sinaloa. In the season of 1915–16,

57 cars were shipped. A total of 300 cars had been expected, but the revolution of 1915 caused a heavy loss to the growers. The record of shipments for the following seasons is as follows: 1916–17, 308 cars; 1917–18, 444 cars; 1918–19, 587 cars; 1919–20, 753 cars. Because of the difficulties of the railroad during the 1919–20 season 50 cars of tomatoes were shipped by water from Topolobampo, Sinaloa, to San Francisco. The estimated crop for that season was between 1,000 and 1,500 cars.

In 1918 there were approximately 5,000 to 6,000 acres planted. Lured by the high prices ($4.50 per lug) which were obtained for some of the 1918–19 crop because of the drowning out of most of the Florida crop, and encouraged by the roseate statements to the effect that the American markets could absorb 10 times more tomatoes than they were getting, western Mexico literally went "tomato crazy" in 1919, and about 15,000 acres were planted.

On the whole, this year was not a very satisfactory one for the growers and shippers. Those shipping early in the season suffered heavy losses. The first cars from Mexico arrived in poor condition, and consequently the receivers became nervous and Mexican tomatoes started the season with a bad reputation. In addition there was an abnormally large tomato crop in Florida, and consequently opening prices were not up to expectations. In addition, it is stated that field troubles took a large percentage and exceptionally heavy toll during the 1919–20 season. Finally, shipments were suspended from April 3 to April 26 because of a strike on the Southern Pacific Railroad of Mexico. This came at a time when the market had partly recovered and tomatoes of better quality were coming out of Mexico. Had it not been for the freezes the first week in January and of the 2d of March in Florida, the losses to all concerned in Mexico, growers as well as shippers, would have been enormous.

### LOCATION OF THE INDUSTRY.

The tomato industry of western Mexico is centralized in two main districts—the Fuerte Valley district of northern Sinaloa and various points in the valleys of southern Sinaloa. In the Fuerte River Valley the acreage is definitely localized in the vicinity of Los Mochis and Constancia, with Los Mochis the shipping point. In southern Sinaloa the acreage is more scattered and tomatoes are shipped from Culiacan, La Cruz, Modesto, Mazatlan, Villa Union, and Rosario. A few shipments were made from Acaponeta in the Territory of Tepic [now the State of Nayarit].

### SOIL.

The soil of Sinaloa is made up of river wash from the mountains and of lowlands which are virtually tidal plains. The soil of the eastern part of the State is composed of gravels, some coarse sands, and clays, while that of the western part is composed of fine silts, a heavy adobe, and fine sands. There is practically no humus except in the low places in the south left by the rivers when they have changed their courses.

In the lower portions of the Fuerte Valley tomatoes are grown on heavy adobe soils, while in the upper portions of the valley and in southern Sinaloa they are grown on a fine yellowish brown silt. A comparatively small acreage is grown in the south on black humus soil. As pointed out before, the industry developed first near Los Mochis, which is the adobe-soil section. Tomatoes were planted extensively for the first time in 1919 on the silt soils of the Fuerte Valley. The heavier soils seem to produce better tomatoes than the silt soils. It was also noted that a wilt, which closely resembles the Fusarium wilt of tomatoes that occurs in the United States, also occurs extensively and severely in the heavy soils of southern Sinaloa, but is entirely absent in the lighter soils composed of silt.

There is practically no fertilizer used in tomato growing in Mexico. In some of the fields which were "running out" guano was applied without results. Apparently there is no nitrogen deficiency, since the vines develop luxuriantly. The apparent abundance of nitrogen in the soils may be due to the rich legume flora. One field of 220 acres was seen which had been in continuous tomato culture for eight years, but from which only 300 lugs—that is, 7,920 pounds of tomatoes—were gathered in four pickings in 1920. There was a heavy blossom drop in this field, and the fruit produced was puffy. In general, the vines in all sections showed a very luxuriant growth. These conditions indicate either a deficiency of essential nutriments or an unbalanced mineral nutrient situation.

### EFFECT OF CLIMATE.

The State of Sinaloa extends from latitude 22.5° to latitude 28° and consists of a terrace which rises from the sea into the mountains. Consequently it has a tropical to subtropical climate. Both tomato sections lie in the so-called "tierra caliente"

belt, which has only two seasons, a hot, rainy summer and a cooler, but very dry, winter. Tomatoes are grown in the cooler, dry winter months from November to May. According to records kept for the period of 1913–1919 by the United Sugar Co. at Los Mochis, the annual rainfall at that station ranges from 20 to 25 inches. The average maximum temperature for this period was 102° F., while the minimum was 40° F.

The average maximum and minimum temperatures during the growing seasons of 1913–1919 were as follows:

| | Maximum. | Minimum. |
|---|---|---|
| November | 95 | 48 |
| December | 89 | 41 |
| January | 88 | 40 |
| February | 89 | 41 |
| March | 93 | 41 |
| April | 95 | 49 |
| May | 99 | 52 |

At Naranjo station, which is further inland from Los Mochis, records have been kept by Mr. Takahashi. Here the maximum temperature during the past four years has been 109° F. in June and the minimum 31° F. in January and February. The average daily range in temperature is 55° F. The maximum and minimum temperatures at Naranjo station during the growing seasons of 1918 and 1919 were:

| | Maximum. | Minimum. |
|---|---|---|
| November | 95 | 39 |
| December | 90 | 41 |
| January | 87 | 31 |
| February | 90 | 31 |
| March | 95 | 37 |

The rainfall during 1919 was 32.21 inches, only 0.56 inch falling during the period from December to May, inclusive.

While the writer was in the Fuerte Valley he noted very heavy fogs at night. These usually disappear very promptly shortly after sunrise.

According to data obtained through the courtesy of the United States Weather Bureau, the annual average precipitation at Mazatlan, Sinaloa, during the past 35 years has been 30.47 inches. The average precipitation during the growing season has been 3.26 inches, and the maximum and minimum temperatures for this period have been:

| | Maximum. | Minimum. |
|---|---|---|
| November | 89 | 51 |
| December | 86 | 40 |
| January | 82 | 49 |
| February | 85 | 49 |
| March | 83 | 50 |
| April | 88 | 48 |
| May | 89 | 55 |

The maximum temperature recorded is 94° F. and the minimum 48° F. The great daily range of temperature noted in every one of the tables cited may be a contributory factor to the delicate structure of Mexican tomatoes, which is responsible for heavy transit losses and which will be discussed later,

Since the tomato crop is grown during the dry season of the year, practically the entire acreage is under irrigation. The fields usually are large, and 200-acre fields are not uncommon. Because of labor shortage, irrigation ditches usually are scarce, and consequently the water is run upon the fields in long trenches. As a result, a part of each field gets an overabundance of water and the other part an inadequate supply. Heavy watering is responsible for a great deal of the soil spots and Buckeye rot found in Mexican tomatoes. The irrigation factor also may be contributory to the poor quality of some of the Mexican tomatoes.

### VARIETIES OF TOMATOES GROWN IN MEXICO.

The Stone is the favorite variety because it has better carrying qualities than the other kinds grown. The Globe ranks next in popularity, and the Bonny Best third.

The Stone has a strong tendency to roughness, cat-face, and puffiness of the fruit, and to blossom-drop. The Globe seems to be more susceptible to diseases than the Stone and also to sun-scald because of the open habit of growth of the vine. Bonny Best is a prolific bearer, but about 60 per cent of the fruit is below 2½ inches in diameter and therefore does not give a good standard pack in the standard Mexican lug. The Stone is a heavier yielder than the Globe.

### THE YIELD.

The average yields are not as heavy as those that are considered good yields in California, although they compare favorably with the Florida yields. The difference in yield between the California and Mexican crops is due to the use of varieties not suitable for the Mexican soils and climate, to the poor cultural methods employed in Mexico, and to diseases and insect pests.

According to reliable reports, the yield per acre has been decreasing steadily. The writer has not been able to determine whether this applies to the total yield per acre as well as to the yield of marketable fruit.

It is stated that the yield of marketable fruit 10 years ago ranged from 4 to 5½ tons. In 1919 the average yield of marketable fruit from the best fields near Los Mochis was a little over 2 tons. During the 1920 season it was averaging only 1½ tons.

In the season of 1918–19, 50 per cent of the picked fruit was discarded in the packing houses. During the 1919–20 season the average of the discarded fruit was about 60 to 70 per cent. In one packing house only 116 lugs were packed out of a total of 1,000 lugs delivered from the fields.

Such a high percentage of unmarketable fruit is a serious matter for the tomato industry in Mexico, because the culls can only be used for cattle feed. There are no canneries or tomato-catchup factories in Mexico.

Naturally, the question arises: "What are the reasons for this diminishing return and the ever-increasing percentage of unmarketable fruit?"

### CAUSES OF DECREASING YIELD.

The decreasing yield probably is mainly due to the increasing prevalence of fungus and insect troubles. As pointed out before, two important diseases seem to have been correlated with the two types of soil on which tomatoes are grown in Mexico. The main factor in reducing the yield on the adobe soils near Los Mochis and on the black soils in the southern part of the State of Sinaloa is a wilt which resembles Fusarium wilt, which is caused by the soil fungus, *Fusarium lycopici;* while the low yield on the lighter soils is due to Cladosporium blight which is caused by the fungus *Cladosporium fulvum.* The writer saw no wilt in the fields grown on the silt soils.

A field in the Los Mochis section was pointed out to the writer which had been considered a banner field. Two pickings were made, and only 130 lugs, or 3,432 pounds, of tomatoes had been marketed when the field had to be abandoned. This field showed fully 95 per cent wilt. The writer failed to find a single old field on the heavy soils that was free of Fusarium.

Wilt was found in fields that had been in tomatoes constantly for from 3 to 8 years as well as in fields that had never been in tomatoes but which had been cropped. A virgin field, however, just cleared, in the midst of the wilt-infested region, showed no wilt at all. It is not at all unlikely that the old cultivated fields, even though they have never borne a crop of tomatoes, have been thoroughly infected with Fusarium by cultivation and irrigation.

The field referred to earlier in this report which has been in tomatoes for eight consecutive years and which showed an abnormal vine growth was on silt soil and did not show a single wilted plant at the time the writer saw it. The writer knows of no better example of plain correlation between a plant disease and nature of the soil than the one just discussed.

At Los Mochis one large field was found in which 50 per cent of the plants had been killed by the fungus *Sclerotium rolfsii.*

The low yield on the light soils of the Fuerte Valley and of southern Sinaloa during the 1919–20 season was due to an exceedingly severe attack of Cladosporium blight caused by the fungus *Cladosporium fulvum.* In some fields the attack by this fungus was so severe that all leaves were killed before the first picking of the fruit.

In the Mazatlan section many fields were overrun by an insect (a species of flea-hopper, *Halticus* spp., according to F. H. Chittenden) which seemed to cause severe damage to the vines. Many fields so affected were also overrun by the fungus Cladosporium in such a manner that it seemed possible that the insect attack weakened the plants preliminary to an attack by the fungus.

Early blight, caused by the fungus *Macrosporium tomato,* was responsible for only a slight decrease in yield in all sections at the time the writer visited the fields. It seems to be far less severe in Mexico than in Florida and is just getting well established. In one field about one-eighth of the leaves had been dropped because of early blight.

Mosaic was quite severe in fields on the silt soils near Constancia in the Fuerte River Valley, and was cutting severely into the yield. Practically no mosaic was noted in the southern Sinaloa fields.

In general the cultural practices used by California tomato growers are used (see Circular No. 147, University of California Experiment Station). Because of inexperienced labor, however, and poor equipment, and an attempt to grow too large an acreage, cultivation, irrigation, setting out, and other operations are carelessly and improperly done. As a result, the yield is not as high as it might be.

The low yield in 1920, therefore, was due to an extensive, rather than an intensive, type of farming, to a wilt which resembles Fusarium wilt, and to Cladosporium blight.

### CAUSES OF HEAVY CULLING.

The heavy culling of fruit in the packing houses is due to several causes. One of them is the advanced ripeness of some of the fruit. It has been noticed that fruit showing any color at all will not carry to the markets of the United States. Since the fields are gone over only once every eight days during the crop season, there is naturally a great deal of ripe or turning fruit delivered at the packing houses.

A very considerable percentage of fruit is culled because of puffiness. The reasons for this puffy condition are not known. Puffy fruit seems to be produced most abundantly on the light soils. Puffiness may be due to several factors. Neither the great daily range in temperatures nor irrigation alone seems to be responsible for it, since puffiness occurs in Florida tomatoes. The fact that it is worse on the light soils might indicate that its cause is in some way tied up with a deficiency or an underbalanced condition of soil mineral nutrients.

An exceedingly heavy percentage of culls is due to insect injuries. The heaviest losses are due to the corn-ear worm. In many packing houses most of the culling is due to its activities. The worm causes severe damage in all sections, but it is most destructive in southern Sinaloa. The writer made a count and estimated that there were about 150 worms on an average-sized plant. The importance of this worm was not understood by the growers and shippers and nothing was being done to control it. Worm-eaten fruit was left in the fields and piles of culls were allowed to accumulate near the fields and packing houses, thus offering the worms ideal feeding and pupation quarters. The wilt and Cladosporium blight cut down the yield, but the corn-ear worm is without doubt the most important cause of the heavy culling in the packing houses.

The injury caused by the green plant bug (*Arvelius albopunctatus*), according to F. H. Chittenden, was responsible for the heavy culling of the first two pickings of 1920. This insect punctures the fruit and sucks the juice, and thus causes excessive dry, pithy lesions under the skin of the fruit. In the ripened fruit these spots have a yellowish appearance. It is the writer's opinion that fruit which does not show many such punctures and is not rough is fit for marketing. It certainly is much more attractive and of better keeping quality than fruit bearing several nail-head spots. Although growers consider this insect the most important factor in the reduction of yield in Mexico during the 1919–20 season, it really was of minor importance compared with the corn-ear worm, the wilt, and Cladosporium blight.

The culling due to fungus diseases is insignificant compared with that done in Florida. Phoma spots were noted on the vines in all of the fields visited, and some Phoma-infected fruit was seen in the packing houses. There was only a slight sprinkling of nail-head spots on the fruit, though some vines were quite severely affected. Both soil rot and Buckeye rot were noted in the field and in the packing houses.

The tomato industry is still so new in Mexico that the diseases which cause the heaviest losses in Florida, such as Phoma rot, due to the fungus *Phoma destructive*, and early blight (nail-head spots) probably can be held down if control measures are adopted and practiced before these diseases become thoroughly established. The heavily wilt-infested adobe soils, together with the hot weather, would offer a fine opportunity to make a severe test of the Fusarium-resistant tomato strains developed by the Department of Agriculture in case the Mexican wilt is the same Fusarium wilt found in the United States.

### LOSSES IN TRANSIT.

The losses in transit are very heavy, averaging 33⅓ to 50 per cent. There are many instances in 1920 of whole cars being total losses, or bringing only 15 cents per lug at market destination. Transit losses, in the main, are not due to fungus diseases, as they are with the Florida shipments, although soil rot, Rhizopus rot, Fusarium rot, Phoma rot, Nacrosporium rot, Buckeye rot, Sclerotium rot, and nail-head spotting do cause damage in the order named.

The heaviest losses of Mexican tomatoes in transit are caused by the characteristics of the fruit itself. Much of the fruit arrives in a very soft condition with the loculi full of juice (known as "water bags" by the trade), or badly wrinkled and flabby.

It is the general opinion of the trade that these conditions indicate freezing and chilling injuries, but these are not the cause. Really frozen tomatoes disintegrate upon thawing out, and chilled fruit will not shrivel more than non-chilled fruit under the same conditions. Mexican tomatoes are normally not exposed to freezing temperatures in the fields nor in transit while in Mexico or enroute to Los Angeles, yet the writer observed the soft, watery, wrinkly, and flabby conditions of these tomatoes at Nogales, Sonora, Los Angeles, Calif., Houston, Tex., and New Orleans, La.

The wrinkled, shriveled condition of the tomatoes is due to the excessive transpiration or water loss. It seems to be most marked in the fruit which shows a tendency toward puffiness and in fruit picked from diseased vines. It may also be correlated with the very thick skin which is characteristic of the Mexican tomato.

Mexican tomatoes have a much more delicate structure and finer texture than tomatoes of the same variety grown in Florida and in California north of the Imperial Valley. Not only is the epidermis thinner but the wall of the fruit and the septa are thinner, the loculi are larger and, when the fruit is ripe, have a tendency to be filled with a watery rather than a gelatinous juice. Such fruits have a tendency to become very soft and turgid as they ripen.

The causes of this condition may be several. It may be due to irrigation, though this explanation does not seem to be the sole one, since irrigated tomatoes raised in California do not show this condition. It may be due to the extreme range of temperature, but this surely is not the only cause, since the fruit grown near Mazatlan, where the temperature range is less than at Los Angeles or Los Mochis, shows as much softness as fruit from the Fuerte Valley. Finally, it may be a matter of mineral nutrients, since the latter fruit grown on the heavy soils in the Fuerte Valley seems to be least affected.

The real reason or reasons for the delicate structure and puffiness of Mexican tomatoes can only be determined by carefully conducted experiments and continued close field observations. Possibly the varieties grown in Mexico are not best adapted to the climate and soils found. Possibly it would be better if the seed used in Mexico were locally produced and not imported from the North.

Uneven ripeness is an important cause of loss in transit. Even at Nogales, Sonora, practically all the shipments inspected by the writer showed from one-third to one-half of the fruit in each lug to be pink or soft ripe, and the remainder still green or just turning. Consequently, whatever treatment is given the cars, whether they are iced or sent under ventilation, a part of the load is maltreated. If the cars are iced, the ripe fruit is kept from ripening or decaying, while the green fruit is chilled; that is, they decay excessively and very rapidly when put into the ripening rooms. If the cars are not iced the ripe fruit becomes soft and leaky because of the Rhizopus, Fusarium, and Macrosporini, respectively, and the sound tomatoes become smeared and wet and thus become exposed to infection.

The corn-ear worm does heavy damage in transit. At times very small worms are overlooked by the packers, but generally the damage is done by the worms which hatch out in transit from the eggs laid in the stem eye of the fruit. These worms are not content to eat one fruit, but usually eat into several of them. Thus the writer found as many as 6 or 7 fruits out of 42 eaten into by one worm by the time the shipment arrived at Nogales. Worm-eaten fruit readily becomes leaky and infected.

Soil rot is caused by the soil fungus Rhizofornia, which also causes heavy loss in transit. There are several records available showing a loss of 15 to 50 per cent due to soil rot. This rot is serious because the fungus is able to pass through the wrapper from one fruit to another. The first car of Mexican tomatoes to arrive in Chicago in 1920 showed 15 per cent soil rot, and this fact was to a very great extent responsible for the low prices paid for Mexican tomatoes.

It seems to the writer that it would be a great economy if Mexican tomatoes were re-sorted either at Nogales before crossing the border, or at Tucson, Ariz., so that the ripe, soft, worm-eaten, and decayed fruit could be culled out and then whole cars of more or less uniform ripeness loaded for shipment. The transit time from Mazatlan to Nogales is about the same as from Florida to Chicago. Before any Florida shipments are sold wholesale, or reshipped, all tomatoes are carefully sorted and repacked.

### HARVESTING AND MARKETING.

The picking is done by Mexican labor, most of which is inexperienced, and consequently a great deal of immature green fruit and fruit of uneven ripeness is brought to the packing houses. As pointed out before, the latter condition is due to the long intervals between pickings (eight days).

No study has been made of the proper degree of maturity for picking. Fruit which is just turning is too ripe for successful shipment. A careful study similar to the one

made in Florida should be made in order to determine the proper degree of maturity for picking to secure the best results in transit.

The fruit is picked into the standard Mexican lug and carted to the packing houses. The long distance of most of the fields from the packing houses, often 3 to 12 miles, the hot sun, the very poor roads, and the springless wagons and carts used, all are factors which contribute very materially to the softness and bruising of an exceptionally tender and delicate fruit.

The packing houses range from improvised shanties in the shade of trees to dilapidated thatched brush and reed huts, to substantial wooden structures which are equal to the best in the United States for the purpose for which they are intended.

The sorting is done by native Mexican labor which is generally superintended by foreigners or Mexicans of foreign birth or ancestry. It is the writer's impression that the sorting was done efficiently and carefully if allowance is made for the fact that the proper stage of maturity has not been determined as yet experimentally, and therefore is not known, and that the significance of the corn-ear worm and of fungus diseases is not understood by either the growers or the shippers or even the packing-house operators. The reasons for the troubles of Mexican tomatoes in transit lie not in the packing houses primarily but in the field.

The sorted fruit is wrapped and packed into lugs which are stamped "Not less than 12 kilos." In the past complaints have been received from the consignees that the lugs did not contain 26.4 pounds upon arrival at the market point in the United States. This shrinkage is undoubtedly due to excessive loss of water content. As a result, the writer found that lugs were being packed with a bulge ranging from one-half to 1 inch. In many cases fruit packed so tightly was carted several miles from the packing houses to the loading station at the railway, and as a result much of the fruit is badly crowded and becomes bruised so that it shows flattened, wrinkled surfaces even before it is loaded for rail shipment Such bruised areas dry out rapidly, wrinkle, or become soft and watery.

The fruit is packed in three layers of 6 by 5, 6 by 6, and 6 by 7, and therefore comes in 26.4-pound lugs containing 90, 108, and 126 fruits each. A pack containing more than 126 fruits is made up of tomatoes less than 2½ inches in diameter and is known as a circle. It is the writer's opinion that the Mexican tomatoes would carry better if they were packed in a container such as the basket Florida crates.

The packing and shipping are done, in the main, by three organizations—the Mexico-Arizona Trading Co., which has shipped tomatoes for seven years and puts up the "Matco" brand; the Liga Agrícola de Sinaloa, which puts up the "Liga" brand; and the Mexican Products Corporation, which ships the "Mexco" brand.

Each lug is stamped with the name of the brand, the abbreviated brand or name of the loading station, and the number of the grower. If the box contains circles, it is marked with a circle.

The fruit is shipped in refrigerator cars, which are loaded according to circular No. 100 of the Southern Pacific Railroad of Mexico. The standard carload is 800 lugs. The loading requirements demand a better-braced car than is generally seen in the United States, and as a result there is practically no complaint about breakage or shifting of the load in transit. The cars move under ventilation, at least as far as Empalme, Sonora, and generally to Tucson, Ariz. All cars are inspected at Nogales, Sonora, just before crossing the border into the United States.

The transit time from Los Mochis to Nogales, Sonora, is from three to four days, and even from four to five days. The shipments from Los Mochis move over the Kansas City, Mexico & Orient Railway to San Blas, Sinaloa, and from there over the Southern Pacific with the rest of the Sinaloa crop into the United States through Nogales, Ariz.

## SUMMARY AND CONCLUSIONS.

The outstanding feature of the Mexican tomato industry is the array of unsolved problems. These must be studied in detail before the industry can or will be conducted as successfully for the growers and shippers as it should be.

In the first place, the matter of suitable varieties should be studied. Experiments should be conducted to determine whether the varieties grown at the present time are the best available for the soil and climate of western Mexico and whether they possess the necessary carrying qualities. Selection and breeding experiments might lead to the discovery or development of varieties that are better suited for Mexican conditions than those now used.

The possibilities of home production of seed also should be investigated. Better results could be obtained if intensive methods of agriculture were substituted for the extensive, inefficient system employed in the past. Better plowing, cultivating, irrigating, and a rational system of rotation of crops will necessitate a reduced acreage per man employed, but would also lead to a larger yield of marketable fruit.

Investigation should be carried on to determine the proper degree of maturity for the picking of the fruit itself, so that it will arrive in the market in a firm, marketable condition.

No diseases were found in the Mexican tomato fields which do not occur in the United States. In fact, diseases, even though they are responsible for a heavy decrease in yield of Mexican tomatoes, are in no wise responsible for losses in the packing houses and in transit to the extent that they are with the Florida crop. Several diseases noted, however, are just getting a foothold. It is urgent, therefore, that the diseases and insects which affect the crop should be studied with a view of determining to what extent they are identical with those found in the United States and to what extent the control methods employed in the United States are applicable to Mexican needs, with a view, if necessary, of working out effective methods adapted to Mexican needs.

In picking and in the packing houses the main trouble is with the peculiarities of the labor employed. With the average Mexican farm labor of the West Coast it is impossible to secure a day's work on the time system, and therefore all work is accomplished under the old Spanish colonial "tarea" or task (piecework) system. Plowing is not done deep enough or thoroughly enough for intensive cultivation under this system, as the ground under the surface can not be checked up by the foremen. Then, again, picking has to be by so much per lug. All sorts of fruit is placed in the lugs in the field in order to make that much more per day with less work. This brings about improper selection of fruit, it being a practical impossibility for the field foremen to inspect every tomato that goes into the crates. The same is true to a less extent in the packing houses, where the work is more concentrated under supervision.

Improper and ineffectual planting and cultivation are always offset by the wasteful and harmful method of giving too much water, it being easier to irrigate a field than to cultivate it properly. The ignorant Mexican farmer or farm hand can not understand the necessity for plant quarantines, inspection, and methods of prevention of disease—attributing to "an unlucky year," to "an act of God," etc., the calamities that result from a lack of such measures. It is the opinion of the writer that effective methods can not be adopted on the West Coast of Mexico in intensive farming until there are more immigrant farmers.

To combat insect pests and plant disease the tomato growers of the Fuerte Valley, in connection with their marketing associations' activities, have obtained the services of an American entomologist, who has been engaged to start the organization of the growers in each section and secure the universal use of sprayers and spray material, Bordeaux mixture and lead arsenate being mostly employed for this purpose at the present time. The native growers have not had much previous experience with prevention methods of this nature, upon the universal application of which depends the future of the winter tomato industry of the West Coast of Mexico, and the ignorance and general apathy of the native workmen make educational work along this line very difficult in that region.

Taking the findings of Professor Link's report given herewith, it may be said that unless active preventive measures are employed on the West Coast the tomato industry will continue to suffer such increasingly heavy losses from plant disease and insect pests that it will no longer be profitable, and this new and great industry for that territory will disappear, to the economic detriment of the West Coast as well as of American commercial interests.

### PLANT-QUARANTINE REGULATIONS OF UNITED STATES.

The United States Department of Agriculture maintains inspection of all cars coming out of the West Coast of Mexico at Nogales, Ariz. Car-lot shipments are not fumigated, as the railway company has provided blanket guaranty that all cars used in the handling of tomatoes from Mexico are used only for tomato traffic, being sent right back again from the United States. All other cars, whether empty or not, crossing the American border into the United States are fumigated at Nogales, Ariz., at a cost of $4 per car, plus switching charges.

The act of August 20, 1912, created the Federal Horticultural Board of the United States Department of Agriculture, which, under the provisions of "Quarantine No. 37," dated June 1, 1919, is empowered to exclude from the United States plants, fruits, and vegetables for the purpose of preventing plant diseases and insect pests in this country. Citrus fruits of the West Coast of Mexico have been thereby excluded from the American markets (where they could easily compete with the products of California and Florida because of the better climatic conditions, much earlier shipment, and lower cost of production) on account of the prevalence of scale, apis, and other diseases and insect pests throughout the West Coast, where little or nothing has been done to prevent their spread in years past. Under the provisions of this quarantine, even the border towns of Nogales, Douglas, and Tucson could not get Hermosillo oranges at $0.01 each delivered at the border on the American side, but were buying California-packed oranges at from $0.60 to $0.90 per dozen at retail.

On December 19, 1922, a meeting of the board was held in Washington to pass on the exclusion under these quarantine provisions of certain products being imported into the United States from the West Indies and Mexico. It was feared by the growers of the West Coast that tomatoes would also be excluded, and a great deal of protest against any such proposed measure was made, it being claimed that no new diseases affecting tomatoes had developed in Mexico different from those already known in the United States and that tomato production in the United States was in no way affected by conditions on the West Coast. It is understood that no action regarding the exclusion of Mexican tomatoes from the United States was taken by the board at this meeting, which dealt only with the products of the West Indies, principally citrus fruits. In this connection it is interesting to note that the press of Mexico City even went so far as to quote the Mexican Minister of Finance as saying that measures of retaliation would immediately be taken against American food products now being shipped into Mexico in large quantities if any such prohibitive measures were adopted for the exclusion from the American markets of the Mexican tomato.

### MEXICAN EXPORT DUTY ON TOMATOES.

March 1, 1922, the Mexican Department of Finance removed the export duty previously in effect on the exportation of Mexican tomatoes, amounting to 0.04 peso per kilo (equal to approximately $0.009 per pound), and this product is now free of export tax.

### AMERICAN IMPORT DUTIES.

Under the provisions of the old American tariff the import duty on fresh tomatoes coming into the United States was 15 per cent ad valorem on an invoice valuation of 2½ cents per pound. Under the provisions of the new tariff act of 1922 (Fordney-McCumber law) tomatoes take a rate of one-half of 1 cent per pound specific import duty, constituting an increase of about one-eighth of 1 cent per pound (the old rate figuring out at about three-eighths of 1 cent per pound). The original schedule proposed on tomatoes in the new tariff act was 1 cent per pound, which caused a wide storm of protest, not only from growers themselves (three-quarters of whom are Americans operating in Mexico), but also on the part of the American exporters to Mexico, represented by the chambers of commerce of El Paso, Tex., Nogales and Tucson, Ariz., and Los Angeles, Calif.

When considering quarantine regulations and import duties on products from the West Coast of Mexico, it is interesting to note the following conditions so intimately affecting the best interests of the United States:

Records show that at least 75 per cent of the tomatoes and winter vegetables produced on the West Coast of Mexico are grown by American planters who employ Mexican labor in the fields, and an investigation conducted in 1922 indicated that about 90 per cent of the capital invested in this industry on the West Coast was directly or indirectly American.

Tomatoes from the West Coast of Mexico reach the American market centers during the months of December, January, February, March, April, and May. No American-grown tomatoes are available for market during December, January, February, or March. Florida is the earliest State to produce tomatoes, but the Florida crop does not mature before April. The Imperial Valley in California follows Florida. Next comes Texas. No other American States produce winter tomatoes, and the only other winter tomatoes produced on the Western Continent are those of the West Coast of Mexico.

Winter tomatoes have reached such a stage of popularity as to be now properly classed as a necessity for the American people. The Mexican crop does not enter into competition with the crops from Florida, California, or Texas. Florida's crop finds an ample market in the Atlantic States, and by the time California and Texas crops are ready for shipment the West Coast season is over. Moreover, the cost of producing and marketing the Mexican tomatoes is so high that they can never successfully compete with the domestic product when once the latter reaches the market. The high cost of the Mexican tomato placed at market is due principally to losses in picking and selection, plant and insect troubles, high transportation costs, and import duty. As a protective measure, an increase in the import duty into the United States is unwarranted.

The only other reason for increasing the import duty would be for the increase in revenue. During the last tomato season there were imported into the United States from Mexico 24,272,000 pounds of tomatoes, on which the United States collected $91,020 in duties. One of the largest and most economically managed tomato farms on the West Coast of Mexico is "La Louisiana," at Los Mochis, Sinaloa (Fuerte Valley), owned by Americans and comprising 610

acres. The following is a statement of the production and marketing costs per pound for this farm for the season of 1922:

| | |
|---|---|
| Cost of growing, including rent, interest, seed, labor, etc. | $0.03550 |
| Cost of packing materials and labor of packing | .01361 |
| Cost of transportation, duties, and commissions | .03622 |
| Total cost per pound | .08533 |
| Gross selling price | .08984 |
| Net profit to grower | 0.00451 |

From the above it is seen that in a bad season the net profit to the grower is less than one-half of 1 cent per pound and that a slight increase in the import duty into the United States would be sufficient to kill the industry, since the margin of profit, on an average, is too small.

The above figures yield the following total results, as set forth in a signed statement of the manager of "La Louisiana" farm:

| | |
|---|---|
| Operating costs, 610 acres tomatoes | $25,283.28 |
| Production cost, labor | 30,975.80 |
| Tomato seed | 334.92 |
| Irrigation water | 3,605.71 |
| | 60,199.71 |
| Net returns on 52,989 lugs | 63,357.48 |
| Net profit to grower | 3,157.77 |

Figures compiled by the Liga Agrícola de Sinaloa, one of the largest shipping associations handling West Coast tomatoes, show that the average net price to the grower per box (lug) during the 1922 shipping season, on shipments from Los Mochis in February totaling 13 cars, ranged between $1.32 and $1.90, the average price being $1.61 per box. On the 71 cars shipped in March the average price to the grower was $1.32; 115 cars shipped during April netted an average price to the grower of $1.25 per lug; and 44 cars shipped during the first 20 days in May netted only $0.894 per lug to the grower. In April and May, 5 cars showed losses of from $0.03 to $0.33 per box.

The following table, prepared by the same association, gives the results of preceding years, as follows:

| Years. | Average net price to grower of tomatoes delivered at packing house. | Average gross sale price in American market. |
|---|---|---|
| 1917 | $0.73 | $1.39 |
| 1918 | 1.35 | 2.14 |
| 1919 | 1.27 | 2.47 |
| 1920 | .79 | 2.06 |
| 1921 | 1.28 | 2.87 |
| Average | 1.08 | 2.19 |

The 1921 cost of freight, duties, and commissions was $1.59 per box of 28 pounds (lug). The average cost of packing in 1920 was $0.3737 per box, and in 1921 $0.4305 per box.

### AVERAGE PRODUCTION PER ACRE.

Careful records kept by the shipping and packing associations show the average production of tomatoes per acre on the West Coast of Mexico to be 111 lugs of 28 pounds each, net weight of fruit, this record and average covering a period of five seasons.

### FREIGHT-RATE NOTES.

Late in 1922 the Southern Pacific Railroad of Mexico secured the permission of the Mexican Ministry of Communications and Public Works to increase freight rates on tomato shipments by 20 per cent over the former rates on carload lots requiring ice. According to the new tariff, 2,000 kilos of ice were to be transported free of charge, but additional ice was to be charged for at the same rate as the contents of the cars carrying ice. The railway gives express freight service on all iced cars. The ice is furnished by the shippers and is supplied from either Mazatlan or Nogales and Tucson, according to the district of the shipment of tomatoes.

### MELONS, WINTER VEGETABLES, ETC.

Experimental shipments of green vegetables from the West Coast to the American markets have met with excellent results, and, on account of the more perishable nature of tomatoes, this line was receiving greatly increased attention from growers in 1920. One San Diego, Calif., produce firm is planting 700 acres of peas and other vegetables on the Ocoroni Arroyo, in the Mocorito River Valley. The total acreage in winter produce on the West Coast for early shipment in 1923 may be said to be about four times that of the preceding season. The varieties raised include green peas, green table corn, chilis, eggplant, string beans, etc. During the 1921–22 season there were shipped to the American markets 33 carloads of chili, 39 cars of green vegetables, and 65 cars of cantaloupes.

In the 1922 shipping season the first cantaloupes from Sinaloa were received at Nogales on April 5, a special fast freight train being run by the Southern Pacific from below Mazatlan for their transportation to market. The quality was said to be excellent. These Mexican melons are marketed before the Imperial Valley in California begins to ship. Estimates earlier in the season, based on actual acreage planted, placed the probable total shipments of cantaloupes from Mexico at 250 to 300 cars, but insect pests, improper cultivation, irrigation and care, poor selection for packing, etc., greatly diminished actual shipments and the bulk of the crop was lost. Cantaloupe shipments from the West Coast of Mexico can be made as early as February 20. The acreage planted in Sinaloa and Nayarit for the 1922 shipping season was estimated at 1,035 acres. After the California product starts moving the West Coast can not compete in the American markets.

The following table shows acreage during the 1921–22 season:

| Districts. | Cantaloupes. | Chili. | Cucumbers. |
|---|---|---|---|
| | *Acres.* | *Acres.* | *Acres.* |
| Fuerte Valley | 250 | 100 | ..... |
| Culiacan | 60 | ..... | ..... |
| La Cruz (Elota Valley) | 75 | ..... | ..... |
| Tuxpan (Nayarit) | 700 | 50 | 50 |
| Total | 1,085 | 150 | 50 |

NOTE.—Villa Union, south of Mazatlan, anticipated shipping about 30 cars of mixed vegetables in addition to tomatoes.

The Hermosillo district in Sonora is very suitable for the production of melons and shipped about 30 cars to the United States in the 1922 season. The expected production that year was 100 carloads.

As in the case of tomatoes, the great advantage of the West Coast lies in the possibility of shipping to the American market centers a month or more in advance of the movement to market of the California and Florida production. As with tomatoes, also, handsome profits were realized from the early shipments beginning in February, and then prices scaled downward as the season advanced. The future of the industry on the West Coast depends entirely upon the ability of the growers to develop a native seed and combat insect pests and plant diseases in a scientific and practical manner. California capital has been extensively interested in the industry, and the benefit of trained and experienced supervision is being given the industry as never before. Southern California produce houses are investing heavily on the West Coast this year, and it may be said again that about 90 per cent of the capital invested in tomato and winter-vegetable growing in this region is American.

The development of this new industry is very vital to the interests of the West Coast as a whole, because the market for other products such as garbanzos and rice is limited at present and winter vegetables are the only sources of a quick return and influx of money with which to balance the purchases of merchandise from the United States.

## FRUITS.

### CITRUS FRUITS.

Grapefruit does very well in the Hermosillo and Yaqui Valley districts of Sonora, where conditions are very much like those of California, but there is no market for this product in Mexico, where it is practically unknown to the people, and it can not be sent into the United States on account of plant-quarantine regulations. A foreign market, other than that of the United States, would have to be developed by water transportation. The growing of citrus fruits on the West Coast of Mexico holds out great possibilities for the future.

The Hermosillo district in Sonora ships about 40,000 boxes of excellent oranges per year, the season being from October to May of each year. Shipments over the Southern Pacific, via Nogales, to the northern central part of Mexico average about 60 carloads per year. The Martinez property near Guaymas produces about 30,000 boxes of oranges per season. Some oranges have been shipped to British Columbia, but this trade has not been well organized as yet.

### DATES, FIGS, ETC., FROM LOWER CALIFORNIA.

Dates, figs, etc., are produced on the gulf side of the peninsula of Lower California, where climatic conditions are ideal for date and fig culture, and the industry has been long established on a small scale for the market on the mainland of Mexico. These products are dried and packed in rawhide cylindrical containers called "surones," weighing 60 kilos each.

The annual production for export to the mainland from the gulf port of Mulege is 300,000 kilos of dates and 30,000 kilos of figs (1 kilo = 2.2046 pounds). Santa Rosalia, Loreto, and the interior back of Mulege produce an annual average of 400,000 kilos of dried dates and 30,000 kilos of dried figs. Receipts of the two products from

Lower California at the various ports of the West Coast for local consumption are estimated at 10,000 "surones" (of 60 kilos each) of figs and from 3,000 to 4,000 "surones" of dates annually.

The production of fruits in the Purisima and Comondu districts (farther south than Mulege) in Lower California for 1921 are as follows:

| | Kilos. |
|---|---|
| Purisima district: | |
| Dates | 40,000 |
| Figs | 89,500 |
| Raisins | 80,800 |
| Comondu district: | |
| Dates | 66,500 |
| Figs | 60,828 |
| Raisins | 49,357 |

Another estimate, based on Government reports, shows that the Mulege district has an annual average production of 1,540,000 pounds of dried dates, of which 660,000 pounds are produced in the immediate neighborhood of Mulege and the remainder in the interior, while the figure for fig production is placed at a total annual average of 66,000 pounds.

These dried fruits are rarely shipped to the United States, as they are not well graded and packed for the American market and do not present a satisfactory appearance. Dates are packed in October and the figs throughout the summer months. It is thought that if interested American importers would give the growers instruction and assistance regarding proper selection and packing methods, labels, etc., the industry could be greatly increased. At present very little of the available good fig and date land has been developed, on account of the lack of population in these districts of Lower California, the general scarcity of water for irrigation, and the need of capital for the improvement and development of the industry on a large scale. Irrigation at Mulege is by means of windmills, as a rule. Soil and climatic conditions in many parts of Lower California are ideal for fig and date culture.

### ALLIGATOR PEARS, OR "AVOCADOS."

Several excellent varieties of the alligator pear, or "avocado," are produced on the West Coast of Mexico, and the fruit forms a staple article of diet of the people. There is a constantly increasing demand for this product in the United States at very high prices—frequently $0.75 each in Los Angeles—but the Mexican product is excluded from the United States by existing quarantine regulations. The tree has been introduced into California in recent years, and the first domestic product is now coming on to the market there, where it is doing very well after years of experimentation.

Limes, pineapples, and the "melon zapote," or papayo, also do very well on the West Coast of Mexico, particularly in southern Sinaloa and Nayarit, although none are exported. It is thought that there is a very good opportunity for pineapple growing on a large scale in the State of Nayarit, and also in the production of the well-known "Acapulco" lime for the manufacture of lime juice. The papayo is a quick-growing plant, produces prolifically, and is one of the sources of pepsin, although present existing plantations are too small and scattered to make the establishment of a pepsin-extraction factory practical on the West Coast at present.

BANANAS.

The banana is grown all over the West Coast south of the Yaqui Valley and does very well, this fruit forming another of the staples of the people of the region. Several varieties are grown, but only in the southern part of Nayarit does the variety so well known in the United States exist at present; the original plants were brought in from Port Limon in Costa Rica in 1910 and 1911 by Americans who planned the growing of this product on a large scale along the coast south of the port of San Blas, Nayarit, some 200 hectares of imported plants being the nucleus of the proposed plantation, which was made impossible by revolutions. The plantation was abandoned by its original owners, and the place has been successively in the hands of several small operators without adequate capital for the enterprise.

Some 25,000 hectares of good banana lands are known to exist in the State of Nayarit south of the port of San Blas and lying along the coast, where there are several small, shallow harbors, principally that of La Palma, at the mouth of the Rio Santa Cruz, which was the location of the proposed banana plantation mentioned above. The "Roatan" variety of banana also does very well in southern Nayarit along the coast and in the immediate river valleys where irrigation can be supplied by gravity from the numerous small streams found in this region. The "Roatan" banana is the variety shipped to New Orleans from Tabasco on the Gulf coast of Mexico.

The small roadsteads mentioned are those of Miramar (La Palma), Aticama, and Matanchil, which have 8 fathoms of water close offshore, though the anchorage is not well protected. Trial shipments have been made recently from San Blas by steamer to Los Angeles and sold for $3 per stem on the open market. No refrigeration was provided, and it was 15 days from the time of cutting until the bananas were sold at the market, showing that this fruit ships well. The Tropical Fruit Co. of San Francisco, Calif., is interested in rehabilitating the old plantation at La Palma and is planning to ship by small vessel to Mazatlan and thence in iced cars to the American border over the railway.

As a rule the plants are set out 4.5 meters apart (1 meter = 3.28 feet) in rows 6 meters wide, showing an average planting of 350 plants per hectare, and the production averages 250 stems per hectare (1 hectare = 2.47 acres).

In the more favored regions of Central America and Colombia bananas produce one stem from every clump of plants every five to seven months, the latter being the more conservative average of production. In Nayarit, on account of the low temperatures in the winter months, rapid growth is more retarded and the production is limited to one stem, for cutting, every 11 months per plant stand. Sufficient labor is available, and, if necessary, more could be drawn from Sinaloa.

An excellent market exists on the Pacific coast of the United States, which is now getting its bananas from New Orleans over a long rail haul. It is thought that a plantation of from 6,000 to 10,000 acres, served by two medium-sized steamers equipped with refrigeration, would prove a good investment now if it were not for the present

land-title features of the Mexican constitution. The principal landowners of the banana region would gladly entertain any reasonable proposal for the development of their properties in this manner.

Near the port of San Blas there is a small plantation (other than the one mentioned above), but the owners are handicapped by lack of capital and means to provide adequate water transportation to the markets of the Pacific coast. Those markets would include San Diego, Los Angeles, San Francisco, Portland, and Seattle, as well as Vancouver, British Columbia, and fruit could be distributed inland as far as Salt Lake City. It is understood that powerful American fruit interests are very much interested in the development of banana lands on the West Coast of Mexico but fear the effect of the present land-title and ownership provisions of the Mexican constitution, which affords no guaranties of ownership of property at present.

### GRAPES.

Mission grapes have been successfully grown in the Fuerte Valley at Los Mochis for many years, the product being sold principally as fresh fruit up and down the coast. Recently 30,000 vines have been planted in the valley of the Presidio River just south of Mazatlan, near Villa Union, by a Spaniard, as an experiment looking forward to the exportation of grapes to the United States. Tha vines were imported from France and Spain. It was thought that certain California varieties would be more suitable to the climate and soil conditions of the West Coast, and experiments with different vines were being conducted, it being planned to set out 200,000 or 300,000 more vines of successful California varieties.

There is an excellent demand for dried raisins in Mexico, and the local consumption would be greatly increased if retail prices could be lowered below present levels charged for imported brands.

The principal difficulty in grape culture on the West Coast seems to lie in the fact that the excessive moisture at the time the fruit is beginning to reach full size, but is still green, causes it to rot at the stem and fall to the ground. Certain suitable lands farther north in Sonora where the rainfall is light and irrigation available are thought to be more suitable than lands farther south where the rainfall and humidity are greater. California gets its rains in the winter, while the Mexican West Coast has its heaviest precipitation in the summer months.

### MARJORAM.

Mazatlan is now shipping a well-known local product of the West Coast to California ports. This vegetable product is an aromatic herb called "oregano" in Mexico, Spain, and the countries of Latin America, which is much used as a condiment with meats, etc. The plant is a perennial shrub 1 to 3 feet high and grows practically wild throughout the West Coast, although it is cultivated on a small scale by the people of the farms and countryside. It belongs to the botanical genus Origanum, natural order Labiatæ. The tops are cut as the plant begins to flower, and the stems and leaves are dried slowly in the shade, after which the product is sacked for shipment and also sold locally on the public market in tiny quantities. It is used as a common culinary savor for meats, etc., in Mexico, Spain, etc.

The first shipment to the United States in recent years was made from Mazatlan in September, 1922, when 4,400 pounds were shipped by steamer to Los Angeles.

## FIBERS.

Nearly all of the foothill areas close to the river valleys of the West Coast of Mexico are suitable for the production of fibrous plants such as henequen, sisal, etc., all species of the agave. This plant does best on hilly, well-drained lands that have a high lime content. The Mocorito region is especially well adapted to the production of this species of fiber. In 1905 Mexico produced 100,484,323 kilos of henequen fiber (1 kilo = 2.2046 pounds), principally in Yucatan, and this production has greatly increased in subsequent years. On the West Coast, Sinaloa exports some 8,000 tons annually of the fiber from the blue "mescal," another species of the agave, the product going to the cordage factories of the Pacific coast of the United States. Unlike the henequen of Yucatan, the blue mescal plant is allowed to mature at the age of seven years; the head is baked in kilns, then macerated and fermented, and the common liquor of the country variously known as "mescal" and "tequila" is distilled from this product. The drink is highly alcoholic, and in color, general taste, and properties is very much like raw corn whisky of high proof.

At the time the plant flowers the leaves are cut off from the head and put through a decorticating machine. The resulting fiber is handled very much like the henequen of Yucatan, which it very closely resembles in length, tensile strength, etc. The henequen and sisal leaves are cut every year, beginning the fourth or fifth year, and the maturity of the plant (when it dies) is retarded from 9 to 14 years thereby, the plantations being handled in rotation.

The largest plantations, and the only ones of any importance on the West Coast, are both in Sinaloa, about 30 miles north of Culiacan. The largest is that of the Retes family at Pericos, where 12 machines each have a capacity of 1,500 pounds of fiber per day. The next largest mescal plantation is that of the De la Vega family of Culiacan, called "Jesus Maria," 30 miles north of Culiacan on the Badiraguato Road. The principal production is that of the liquor mentioned, the fiber being a by-product. Both plantations have a large acreage in sugar cane, from which the native brown sugar of the country is made, as well as alcohol. The blue mescal variety of the agave produces a smaller percentage of fiber per unit of weight of the leaf than henequen or sisal, the leaves being much larger and having more watery pulp than the dry henequen.

On account of the excess production of henequen fiber in Yucatan and the low prices prevailing since the war for this product, it is not thought that the industry of fiber production can be increased profitably at the present time on the West Coast of Mexico.

## SESAME SEED.

Sesame seed, known in Florida as "benny" seed and in Mexico as "ajonjoli" seed, is not grown in any of the three West Coast States covered by this report. The States of Guerrero and Michoacan are the largest producers of this oilseed in Mexico, the estimated annual production prior to the revolutionary period being about 3,000,000 bushels. Production has decreased greatly in Michoacan during the past 10 years. In 1913 Mexico exported 2,500 tons of sesame seed, valued at 345,601 pesos, about 50 per cent of which went to Germany. Since that time domestic manufacturers of soap have taken most of

the available supply, which is shipped by way of Manzanillo to Mexico City, Guadalajara, and other points of the interior. The crop is harvested in the months of October and November. Small quantities were formerly shipped to the United States but were discontinued in 1921. During the shipping season about 10 cars per month can be obtained from dealers—with the domestic soap manufacturers of Mexico keen competitors for the crop output.

## MEXICAN LAND LAWS.

For the information and guidance of those interested in lands on the West Coast of Mexico there is reproduced herewith a translation of subdivision 1 of Article 27 of the Constitution of 1917, which now forms the fundamental law of the Republic of Mexico:

Only Mexicans by birth or naturalization and Mexican companies have the right to acquire ownership of lands, waters, or their appurtenances, or to obtain concessions to develop mines, waters, or mineral fuels in the Republic of Mexico. The Nation may grant the same right to foreigners, provided they agree before the Department of Foreign Affairs to be considered Mexicans in respect to such property, and accordingly not to invoke the protection of their Governments in respect to same, under penalty of forfeiture to the Nation of the property so acquired. Within a zone of 100 kilometers (62.13) miles from the frontiers, and of 50 kilometers from the seacoasts, no foreigner shall under any conditions acquire direct ownership of lands and waters.

The Constitution also grants the right to the various States to fix a maximum area of land that may be acquired and held by any one individual or concern. For the State of Sonora the legislature, by law passed on June 23, 1919, made the following limitations:

ARTICLE 14. The maximum area of land that may be owned by one person or company legally organized is as follows:

Fifty hectares in privately owned lands located in the zone that was originally surveyed as public land.

Outside of the zone above mentioned, the maximum area shall be:

A. Irrigable agricultural lands, 100 hectares.

B. Dry farming lands, 300 hectares.

C. Grazing lands, 10,000 hectares.

ART. 15. In the areas fixed by the foregoing article may be included one lot or several lots belonging to the same proprietor, be they located together or on different lots belonging to the same proprietor, in different municipalities.

The agrarian provisions of the Mexican Constitution of 1917 are for the express purpose of forcing the subdivision of the large landed estates for which the country was famous, and it is the avowed policy of the Government to assist individuals to acquire and develop small farms without the intervention of large companies which buy great tracts of raw land, provide water for irrigation, and then sell the land in small farms to individual farmers, as is the practice in the United States and as was the tendency on the West Coast before the revolutions stopped such development.

The National Government even went so far as to purchase large amounts of agricultural equipment which it tried to sell to the small farmers, or prospective farmers, at cost, plus 5 per cent, on the installment plan. Many thousands of acres of choice lands in each State have been alloted to individuals under the new Agrarian Law of the country, but the provisions of the law have been almost universally defeated by the lack of ambition and education and the general apathy and indifference on the part of the average individual affected. The law states that payment shall be made for

lands so "expropriated" for the benefit of the Nation, but no real provision for such payment has yet been made by the Mexican Government, except that it is planned to issue land script for this purpose at some time in the future.

### LANDS TAKEN UNDER AGRARIAN LAW IN WEST COAST TERRITORY.

Up to the end of 1922, a total of 120 villages had received lands and a total of 119,749 individuals had been benefited—the extent of land covering a total of 886,949 hectares (1 hectare = 2.47 acres) since the inauguration of the Obregon administration. For the regions discussed in this report the figures are as follows:

*Lower California.*—Three thousand four hundred and fifty-four individuals belonging to 4 villages, received lands totaling 3,511 hectares taken from national lands.

*Nayarit.*—Three thousand one hundred and twenty-one individuals, belonging to 10 villages, received a total of 28,703 hectares, of which 14,475 were already owned by the people affected, and 14,276 hectares, of which 4,100 were national lands, were divided, a total of 32 estates being affected.

*Sinaloa.*—Two thousand six hundred and fifty-seven individuals, belonging to 10 villages, received lands, 19,936 hectares being expropriated, and the total area now possessed by the people of the villages affected being 44,650 hectares.

*Sonora.*—One thousand six hundred and thirteen people were given lands in Sonora, a total of 18,100 hectares being expropriated for this purpose, of which 16,752 hectares were national lands.

There is no agrarian problem on the West Coast of Mexico. The people of the country districts have always held more than sufficient lands around their "pueblos" for their needs, and the problem of the West Coast is not one of land for the people in order that they may be self-sustaining, but rather one of the lack of sufficient labor to work the existing lands. The average individual of the West Coast prefers to plant a small amount of corn on some hillside (where he can use his only tool, the machete, and where he does not have to plow or cultivate after burning off the brush) and, during the rest of the year, to work for some proprietor, or at some mine, or on the railway, or about town.

In California, under the American system of purchase and cutting up of the old, large landed estates, prosperous and self-sustaining new communities have been created in less than 10 years, the towns being modern, with fine schools, churches, streets, complete public utilities, etc., and having a high production record. On the West Coast of Mexico the character and racial peculiarities of the people are such that this system does not work out as it does in the United States. It is a matter either of an age-long program of popular education, or of letting the foreigner do it; and the national attitude of Mexico toward foreign enterprise seems, at present, definitely unresponsive.

### FARMING CONDITIONS FOR FOREIGNERS ON WEST COAST.

Sonora is a desert country in which conditions are very much like those of Arizona and New Mexico. In Sinaloa the good land lies in the several river valleys described herein, and conditions are more tropical, so far as heat and moisture are concerned, than in Sonora, which is a dry country. The great attraction for the American farmer of moderate means is the cheap first cost of the land. Land tracts, containing both good and poor lands, can be purchased from the original Mexican owners of these large estates for from $0.50 to $5

per acre, depending upon the amount and proportion of arable land contained in the tract, the water possibilities, the location, etc. Choice river-valley lands with water by irrigation can be secured for from $15 to $30 per acre in colonization communities already started by Americans. When titles are considered, however, there are always the present provisions of the Mexican land laws to be faced.

The small farmer with a family contemplating the purchase of land on the West Coast to-day faces a pioneering undertaking, with the complications of an unresponsive native population and the fear of unjustifiable acts on the part of local officials.

The West Coast is a hot country where climatic conditions are trying and where few white men can work all day in the sun. Malaria and other tropical diseases are rife, but not in a very virulent form, as a rule.

Away from the railway there are no roads as such are known in the developed districts of the United States—merely dirt tracks impassable for wheeled traffic during the rainy season of each summer.

One of the attractions held out by persons interested in selling West Coast lands to Americans and foreigners is that of cheap labor, wages for farm work now averaging 1 Mexican peso per day. However, this labor is not very efficient, it can not be depended upon, and the supply under normal conditions is not sufficient. American farmers putting in crops have learned that, at the end of the season, costs have been materially reduced by the use of tractors and modern machinery handled by skilled men from the United States—the element of time for the short crop season being the fundamental factor to be considered in this connection, together with the money investment involved.

Except in the case of winter tomatoes, there is the very important question of markets to be considered. The American farmer can not compete with the native in the production of corn and beans, the two great staples of the country, and in a year of overproduction of these crops, the surplus can not be shipped to other markets to any extent.

## COLONIZATION AND INVESTMENT.

The two largest agricultural colonies of the West Coast are those of the Yaqui and Fuerte Valleys, the latter located at Los Mochis, where the United Sugar Co. has encouraged planters in the production of sugar cane for the company's mill, and where other crops are also produced by about 75 American farmers. The number of Americans engaged in farming in the Yaqui Valley is approximately 100. There are about 5 Americans engaged in agriculture in the Culiacan Valley permanently, although a number of new people have come in on leased land for winter-tomato production this last year. This is also true of the Sinaloa River Valley farther north, where a very large acreage is being put in for the 1923 season of winter tomatoes and vegetables, Americans being sent down to supervise the crops and the packing and shipping.

A recent very conservative estimate of the total investment by Americans in land in the West Coast States of Sinaloa and Nayarit placed the sum at $11,495,000 United States currency. The total investment in mines was placed at $13,760,000; that of the Southern

Pacific Railroad Co. of Mexico at $15,000,000: that of the Kansas City, Mexico & Orient Railway at $2,000,000; and the investment in business and industries of other nature at $387,000.

Most of the land originally purchased by Americans on the West Coast was obtained in very large tracts from the original Mexican owners for investment purposes, it being the plan of the new owners to subdivide and sell off their tracts in small lots with water for irrigation. This colonization plan has been suspended by conditions in the country and by the new agrarian laws of Mexico, as previously pointed out herein.

Japanese colonization interests were supporting the development of irrigation by the Compañía Agrícola Tepiqueña in the Santiago Valley in Nayarit during 1910 and 1911, but this scheme for Japanese colonization failed on account of the conditions brought about by the various revolutions in Mexico since then, the Japanese Government refusing to visé passports for its citizens to go to Mexico.

The Japanese of California have been active in the Sinaloa Valley north of Culiacan during the past few years, but have failed to establish a permanent agricultural colony on account of the lack of water for irrigation and their lack of sufficient capital to provide the necessary water by means of reservoir dams and canals. Early in 1912 a group of Japanese of Los Angeles (Nichi-Boku, 105 East First Street, Los Angeles), interested in selling lands to their own countrymen who had made money in California in agriculture, made a contract with the Mexican owners of the "Tetamecha" hacienda situated on the Ocoroni Arroyo, an affluent of the Rio Sinaloa, the lands being located near Bamoa at Naranjo Station on the Southern Pacific line. Eighty-five thousand acres were contained in this tract, which was held under a selling contract providing for release of title as the lands were sold in small allotment to the Japanese colonists to be obtained by the selling agents in California. During 1915 some 75 to 100 Japanese were attracted to this land by the selling company but failed to make a success of their efforts on account of the lack of water for irrigation, and the colony is now abandoned. The purchase price of the land was $2 an acre, and the selling agents secured enough money from their buyers to clear title to about 20,000 acres, which have been released to them by the owners under the terms of the original sales contract. The total investment is between $50,000 and $60,000 United States currency.

The Japanese farmers must have water for irrigation, and they are being attracted to Los Mochis and to the Culiacan Valley, where conditions are better than on undeveloped land without water. In the Culiacan Valley there are now two Japanese families, and 10 Japanese in all are located at San Pedro and La Colorada. A Japanese engineer has 114 acres of highly improved land in the La Colorada tract. Culiacan has two Japanese doctors, two Japanese dentists, and four or five others engaged in various minor pursuits. The Japanese refuse to pay high subdivision prices for land and prefer to purchase in small lots directly from Mexican owners.

No capital is coming to the West Coast of Mexico from Japan for investment in Mexican lands, and all recent effort at Japanese colonization in this region seems to have depended upon the support of Japanese from California.

The United Sugar Co. at Los Mochis, in the Fuerte Valley, is very much interested in securing Japanese colonists for sugar-cane production, and has had an agent for this purpose in Japan for some time past. Six families have been induced to come thus far, and the company expects to have 25 families more by the middle of 1923. The plan is to attract Japanese farmers from Japan for cane production, the company assisting them to obtain mules and implements and selling them the land on easy payments in order to develop a dependable supply of cane for the mill. It is desired to enlarge this mill and increase its grinding capacity. Under this plan the Japanese immigrants would eventually own the land. The sugar company can not depend upon the native Mexican labor, and the American colonists want to own their land and farm independently, raising more profitable crops of winter vegetables, tomatoes, etc., for themselves. The American colony at Los Mochis and in other parts of the Fuerte Valley now numbers about 150 individuals.

From time to time foreigners interested in the promotion of land colonies in Mexico have been attracted to the Sonora River Valley in the region north of Hermosillo, where there is a possibility of the development of a water supply for irrigation by means of storage dams. In the early part of 1919 Japanese engineers made a preliminary survey of the region and two proposed storage dams of the submerged type, and negotiations were undertaken with the State government officials toward the necessary concession, etc., the investment being estimated at about $6,000,000 Unites States currency. Latterly, this project for the Sonora River has been variously surveyed by the Mexican Government, but funds are not available for the work at present.

### LAND TAXATION.

Under the new taxation regulations of the Mexican Government land taxes have been heavily increased. These are collected by the State governments, the rate being 10 per 1,000 ad valorem of the appraisement valuation, plus 25 per cent for Federal Government tax, which is paid in revenue stamps affixed to the tax receipt from the State. Real property taxes are payable three times a year, during the first 10 legal business days of January, May, and September. The legal valuation of the land is fixed by the State assessor, who sometimes takes the owner's valuation and at other times is governed by his own idea in the matter; this leads to many abuses in the way of evasion of legitimate taxation and also excessive rates for those least able to pay. In 1922 the Sonora State government reduced land taxes by 50 per cent in an effort to collect revenue due from back and unpaid land taxes; it received, however, but little immediate response, most of the large landowners holding back for a better definition and clarification of the land taxation laws. As a general rule, land taxes can not be said to be exorbitant in the West Coast States of Mexico at the present time.

### RENTAL RATES AND CONDITIONS.

Raw land can be rented or leased at very reasonable rates from native landowners who own large tracts, but little of such land is provided with water for the necessary irrigation, and the present

interest is in the production of winter tomatoes and vegetables for the American market, requiring choice and developed land with a sure and plentiful water supply. In any case, land rentals depend upon the stage of improvement of the land itself, the water provision, the location as regards transportation, etc.

As an example of rental lands the improved lands of the Fuerte Valley can be cited. One form of land rental contract is on the basis of 50 per cent of the crop to the renter and 50 per cent to the owner, the latter furnishing the land, water, mules, and equipment for the season, including also the necessary seed for planting. Other forms of rental contract give 40 per cent of the crop to the landowner who furnishes the land and water only. Both forms of contract are varied to suit individual conditions and agreement. Good tomato land is also rented on a cash basis, the rent being paid in advance and ranging between $10 and $20 per acre per year, depending upon location, condition of the land, etc., with the renter paying for everything but land taxes.

In a number of recent cases American produce houses interested in securing large supplies of winter tomatoes and vegetables have made arrangements with native landowners to assist them in financing the crop, the produce houses having their own men supervise the work on the ground.

First-class, well-located river bottom land under the new Culiacan canal can be purchased for $15 an acre. This land is not cleared or ditched for irrigation, but is very close to railway transportation and within 15 miles of the city of Culiacan. The cost of clearing and stumping, fencing, leveling, and ditching for irrigation would run about $60 United States currency per acre the first year.

## CONCLUSIONS.

The future of agricultural products on the West Coast depends upon three conditions—the development of export markets; the introduction of more modern and scientific methods (in which the education of the people is involved); and immigration to the coast of an agricultural class of people. The West Coast people themselves will progress in agriculture in direct ratio as the example is set for them by people from the outside. The solution is, of course, involved in the social and political problems of the country as a whole and the attitude and policy of the Government toward foreign immigration and development of resources by foreigners. Present legislation is not favorable to this development by foreigners (Americans), despite the very great interest manifested in the West Coast by the people (especially the investors) of California and of the United States as a whole; and the general attitude of the Government seems to point toward the policy of exclusion of foreign interest or penetration.

On account of topographical barriers and geographical location, the interests of the West Coast are more closely bound up with those of the Pacific Coast and western part of the United States than with the central part of Mexico itself; these mutual interests are being developed and rapidly cemented as time goes on and the problems of relationship of the two peoples should be worked out to mutual satisfaction on the basis of mutual advantage and help. In spite of the great difference in racial characteristics, the younger men of

the West Coast of Mexico are beginning to get the American viewpoint and thought, and this influence is beginning to make itself felt throughout the region under discussion. The younger generation of the educated class on the West Coast are now only too glad to associate themselves with Americans for the development of the resources of their region of Mexico. The development of the formerly arid waste of the Imperial Valley in southern California and of irrigation and highly developed agriculture in California as a whole has been to them a great educational example which they have studied and are eager to take advantage of.

## IRRIGATION AND POWER PROJECTS.

Nearly all the rivers of the West Coast of Mexico have more or less suitable and advantageous storage-dam and power sites above the railway and in the regions of the first narrow passes into the higher mountains.

### FUERTE RIVER STORAGE-DAM PROJECT.

The annual run-off of the Fuerte River has been calculated at 4,480,000 acre-feet of water. There are two proposed storage-dam sites, both of which have been recently surveyed for the account of the United Sugar Co. at Los Mochis, with the idea of providing gravity irrigation for the sugar and agricultural lands in the lower valley, where water in the dry season is now being supplied by means of large pumps. One dam site is located near the mining town of Choix and the other at a point called Yecarati. Early estimates showed that a total of 96,000 acre-feet of irrigation water could be provided at a cost of $570,000 United States currency. However, it is doubtful whether the plans of the company will be carried out for some time to come, on account of the recent action of the Mexican Government through its agrarian commission toward the confiscation and parceling of the lands of the valley, including the water rights held by the company under an old concession.

### BACUBIRITO POWER SITE.

The Bacubirito power-site proposition consists in cutting through a rocky ridge, which would mean a cut-off on a 10.5-mile loop of the river. The cut is 832 feet long between portals and would give an 81-foot fall. The location is on the Sinaloa River, about 50 kilometers (1 kilometer = 0.62 mile) above the railway, near Bacubirito. In connection with this power site there is the possibility of a storage dam that would increase the fall and double the possible electric horsepower to be developed. The dam for this reservoir would be located between rocky hills with the bedrock beneath the stream at not more than 25 feet. The dam would be some 650 feet long. There are 90 feet of the cut completed through the ridge now (executed by the old concessionaires, Felton Bros., of Mazatlan) in the form of a tunnel. The minimum horsepower from the stream during the eight months would be 2,000 and for four months of the extreme dry season 700. The cost, without storage dam, was estimated at $200,000.

### FLOW VARIATIONS IN RIVERS.

In considering irrigation or power projects on the West Coast it is very necessary to bear in mind the great variation of flow of the rivers between flood and dry periods of the year. A striking example is that of the Rio San Lorenzo south of the Culiacan Valley. Its flood flows are 8 to 10 times as great as the greatest flow in normal times. The extreme low-water stage of this river below the region where it receives the waters of the Rio Nuestra Señora, the Rio Camarones, and the

San Gregorio is only 64 cubic feet per second. Below Casa Blanca the flow is only 100 cubic feet per second. At San Lorenzo, lower down, the combined flow is only 14.09 cubic feet and 17.99 cubic feet per second in the two channels. The annual average discharge of this river is 1,920,000 acre-feet of water.

### SAN DIMAS POWER-DEVELOPMENT PROJECT.

American mining interests and San Francisco capital have recently been actively engaged in the survey and investigation of a proposed power development near the mining town of San Dimas just over the Sinaloa State line in Durango northeast of Mazatlan. The following account is taken from a report by American Consul W. E. Chapman, of Mazatlan, dated December 4, 1922:

The project as it now stands contemplates the installation of one high-head electric generating unit of 25,000 horsepower, transmission being over about 275 miles of power and lighting current line. This mileage includes present estimates of all numerous branch distributing lines radiating to points of consumption extending over the greater part of the State of Sinaloa as far north as Culiacan, the capital.

The water race for this unit will have a fall of 2,360 feet to the generating machinery, making it one of the most unique high-head plants of the world.

There is also planned an auxiliary unit of 1,500 horsepower, operated on a relatively low water head with a fall of about 500 feet. This auxiliary unit will be installed in advance, according to present plans, as the current from it can be utilized to great advantage in driving the long tunnel which it is necessary to cut through the mountain for a distance of about 14,000 feet, above the head of the water race of the larger unit. Arrangements are now being made, it is reported, to commence the work of installing this smaller plant, actual operations being intended to start in February or March, 1923, for completion by August of the same year, when the power thus developed will be immediately available for the tunnel construction work.

It is also planned to commence work within three or four months on a large dam for storage reservoir capacity, the dam being at first 80 feet high and to be constructed in such a manner as to be easily enlarged later. At 80 feet height the dam will form a lake 7 miles in length. Irrigation water for the lands lower down toward the coast will also be made available.

### SANTIAGO RIVER IRRIGATION PROJECT.

Prior to 1910 the Compañía Agrícola Tepiqueña secured a concession from the Mexican Government for the use of the waters of the Santiago River in what is now the State of Nayarit, then the Territory of Tepic, at the same time making a contract of purchase with the owners of the Hacienda San Lorenzo, which extends from the Pacific Ocean north of the mouth of the Santiago River inland along the north bank for a distance of some 60 kilometers to a point just east of the town of Santiago Ixquintla, which is on the river. This property contains 24,240 hectares (1 hectare = 2.47 acres), and it was planned to subdivide and furnish water for 20,000 hectares of the choicest lands for a large Japanese agricultural colony, this tract being located between the arroyo of Laguna de la Punta and the boundaries of the property, west to the ocean.

The lands in question were subdivided into lots of 5 hectares each, with main and lateral roads of 20 and 10 meters width in between, with a town site of 200 hectares reserved near Santiago Ixquintla. In 1910 the canal work for irrigation was well under way, and it was hoped to have 5,200 hectares of land under cultivation by Japanese the following year. In order to provide water immediately a pumping plant with a capacity of 1,000 liters per second was installed at a point on the river just below the town of Santiago Ixquintla. This

plant was badly installed, without proper foundations, and has been practically ruined by the flood waters of the river since then.

### SOIL CONDITIONS.

Some of the lands selected for the Japanese colony were located on an elevation surrounded by a depression and could not be reached by the waters of the main canal as planned, water service to this portion of the tract being provided by means of the pumping plant mentioned, although the canal would bring the elevation down to 2 meters from 4 meters (1 meter = 3.28 feet) if taken from the main river channel below Santiago. In general, all the lands subdivided were level lands with a slight incline toward the river and ocean, with tide land at "El Puente" and "Los Sauces." The uniformity of the tract is broken by small arroyos, tidal inlets, and ponds formed during the rainy season of the year. The greater part of the tract is covered with brush and some good hardwood timber, but the Compañía Agrícola Tepiqueña had contracted with the Japanese colonization agent to deliver these lands clear of brush and trees and ready for cultivation.

The lands are mostly composed of a sandy clay soil, reddish-yellow in color and very deep, the average depth of the alluvial fill being between 2 and 3 meters (1 meter = 3.28 feet). Under the cap of the humus soil there has been found, in many places where tests have been made, a stratum of kaolin and feldspar probably sufficiently abundant to be used in ceramic industries. The elevation ranges from sea level to about 50 meters at the eastern end of the property and toward its northern boundary.

During the periods of heaviest floods of the Santiago waters of the river invade this property in various places, inundating the lands for considerable areas; and the irrigation project included levee construction to prevent this condition.

### FINANCES.

Under the provisions of the act that created the Agricultural Loan Bank of Mexico, known as the Caja de Préstamos, during the Diaz régime, the Compañía Agrícola Tepiqueña secured a loan of 1,000,000 pesos with which to develop and improve this property, which, after most of the money was spent in the irrigation canal, levees for flood-water control, etc., has reverted to the ownership of the Caja de Préstamos of the Mexican Government, because the succeeding years of revolution in Mexico put a stop to its development by the Japanese colony which was planned.

### VALUATION OF PROPERTY.

According to a report made in March, 1911, by the engineer acting for the Caja de Préstamos, it was shown that the lands were for the most part lying idle but were capable of a high production if provided with a water supply under control and if properly worked. A valuation of less than 5 pesos per hectare was placed on the lands in their natural state and 1 peso per year as the grazing value of lands not subject to irrigation. Of the total extension of the property, 30,000 hectares were declared to be subject to irrigation, when their value would be 33 pesos per hectare, and the average mean flow of the river was declared to be sufficient to irrigate this tract without

the provision of storage dams for impounding water for use during the dry season of the year when the water would be most needed. The preliminary cost of the main irrigation system as planned by the engineers of the agricultural company was placed at 37 pesos per hectare. It is stated that the average cost of irrigation systems per hectare in the Punjab, Madras, and Bombay, British India, is 40.40 pesos.

The initial cost of the irrigation system sufficient to water a total of 16,000 hectares by gravity flow at the dry season was estimated at 600,000 pesos, and the value of the lands with water at 2,400,000 pesos, or 150 pesos per hectare, the raw land value without water for the 16,000 hectares being less than 500,000 pesos.

### COLONIZATION PLANS.

The original plan of the Compañía Agrícola was to provide water for these lands, subdivide them, and sell them to settlers on the installment plan, Asiatic colonists being preferred to American or European because the former were thought to demand less and to be more efficient workers in the hot and somewhat unhealthful climate.

### CANAL CONSTRUCTION.

In 1911 the main supply canal was completed for a distance of 50 kilometers (1 kilometer = 0.62 mile), and 64.5 kilometers of lateral canals were finished, as well as the pumping plant to irrigate a total of 2,000 hectares, or 4,942 acres, of land, just below Santiago Ixquintla. The entire system has been allowed to fall into decay; canals have filled up by erosion during the 10 years of disturbed conditions in Mexico, the Santiago River levee has been repeatedly washed away in several places by the floods during the rainy season, and the whole system is wrecked for all practical purposes at the present time.

The main water-supply canal has a capacity of 10,000 liters per second, and in June, 1913, was completed as far as station 25, to kilometer 14.5. Secondary canals Nos. 1, 2, and 3 were completed, as well as No. 4 from kilometer 12. All the ditches for the pumping station were completed. The main canal was estimated to cost 240,000 pesos and actually cost 364,630 pesos. The pumping plant alone, without ditches, cost 70,282 pesos, installed. It was reported that 100,000 pesos more were needed to complete the main canal and reinforce damaged parts of the river levee. This expenditure would, according to the estimate made in 1913, place 5,000 hectares under irrigation, of which 2,000 hectares would get water from the pumping station.

Colonization was thought absolutely necessary to the development of this property on account of the prevailing shortage of labor in that district of the West Coast. Powerful Japanese interests were concerned in this project in the Santiago Valley, which is one of the richest on the entire West Coast, and where abundant water is available for irrigation at the lowest stage of the river during the dry season. The project is now in the hands of the Caja de Préstamos, or National Agricultural Loan Bank, of the Mexican Government, and its rehabilitation depends, like the future development of the other river valleys of the West Coast, upon foreign immigration and colonization.

The title of the land is also involved by reason of the claims of the original owners against the Compañía Agrícola Tepiqueña, which is now insolvent; but the claim to the property by the original owners (family property) can not be made valid on account of the interest of the Caja de Préstamos.

### SAN PEDRO RIVER PROJECT, NAYARIT.

The Tepic Agricultural Co. also held a concession from the Mexican Government for the use of the waters of the San Pedro River in Nayarit just north of the valley of the Santiago. Plans called for the construction of a canal to carry 3 cubic meters of water per second through a main canal 7 kilometers long, with various secondary canals for the irrigation of about 2,000 hectares of lands in the San Pedro Valley. The valley of the San Pedro is more rolling in character than that of the great Santiago delta, and some heavy cuts for the main canal were necessary. The intake was planned at a point some 30 kilometers up the stream from the town of San Pedro, called Vado ("ford") de San Pedro. In connection with this project electrical power totaling 330 horsepower was to be developed The revolutions in Mexico interfered with these plans also, and the water-right concession has since lapsed.

Winter tomatoes and cantaloupes are now being grown in the San Pedro Valley, without irrigation water, for shipment to the United States in February and March.

### CANAL "ROSALES," CULIACAN VALLEY.

The irrigation systems of the Yaqui and Fuerte Valleys have been described previously in this report. Both systems were constructed by American companies. The latest irrigation system is that of the Culiacan Valley, constructed by the Mexican Government entirely with Mexican technical talent. This new canal is designed to irrigate a total of 60,000 hectares of land (1 hectare = 2.47 acres) in the Culiacan River Valley below the city of the same name, the intake being at the edge of the town, just below the junction of the Tamazula and Humaya Rivers, and right at the Southern Pacific Railway bridge which crosses the river just below the town.

The Canal "Rosales," as it is called, was constructed with money advanced by the Mexican Central Government to the State of Sinaloa through the initiative of Gen. Angel Flores, governor of the State and military chief of the West Coast Zone. From the time the work started, in 1920, up to the completion of the headgate and intake, the main canal, and its principal southern and northern branches, a total of 2,200,000 pesos ($1,100,000) had been expended in its construction, and there still remained, in October, 1922, something like 800,000 pesos more to be expended in the construction of secondary canals, structures, etc., bringing the total cost up to 3,000,000 pesos or $1,500,000 United States currency. The sum still needed is to be contributed by the State of Sinaloa from current revenues of the State as the money may be needed.

For the adminstration of this canal, a Mexican corporation in the form of a mutual water company has been formed, having a total capitalization of 3,000,000 pesos. The State of Sinaloa will receive shares for 2,200,000 pesos, representing the actual cash outlay for the

canal to date, and an additional amount of shares of 800,000 pesos as installments on this sum may be contributed toward the completion of the work, the maintenance of the canal itself, etc.

The landowners of the valley are expected, in time, to take up these shares in the mutual water company from the State at the rate of 50 pesos ($25 at par) per share, each share representing the water right for 1 hectare (1 hectare = 2.47 acres) of land under the irrigation system of the canal. The shares representing this water right are inalienable separately and can be disposed of only with the land itself. In this manner it is expected that the landowners will gradually absorb the water company and eventually own the canal system. Water shares can be purchased by the landowners in small payments—10 per cent for the first payment and the balance in 20 annual installments. After one year, 6 per cent interest will be charged on installment payments for water stock due.

### WATER PROVISION AND ALLOWANCES.

The engineers in charge of this canal work estimated that this land requires a total of 5,000 cubic meters of water per year (crop season) per hectare, and this figure is being used as a basis for the calculation of water comsumption under the well-known "bolsa," or pocket, system. (1 acre = 4,046.87 square meters; 1 hectare = 10,000 square meters.) This means that every hectare of land irrigated will receive a total of 50 centimeters, or 1.66 feet depth, of water during the irrigation period of the year. This figure may later be increased to 60 centimeters depth, but it is thought that, given the natural moisture of the soil of this valley and the relatively shallow depth of the clay subsoil, this amount of water per hectare will be enough with the adoption of the "bolsa" system of irrigation, whereby the land is flooded in small banked areas, the soil retaining the maximum benefit of the moisture thus applied. In this connection it is interesting to note that the cotton lands of the Imperial Valley in southern California take a miminum average of 7.3 acre-feet of water per season, but that in this latter region the mean annual rainfall is only about 2 inches, whereas in the Culiacan Valley the rainfall averages 16 inches at Culiacan at the apex of the valley and about 10 inches in the region farther toward the coast.

### WATER RATES AND CHARGES.

The charge for water from this canal for irrigation purposes is placed at 1.50 pesos ($0.75) per 1,000 cubic meters of water at intake from the canal laterals. The water charge in the Imperial Valley is $0.85 per acre-foot of water used. At the minimum figure of 50 centimeters of water surface depth per hectare per season for this land, it will take 2,034.4 cubic meters of water per acre, for which the charge would be at the above rate of $0.75 United States currency per 1,000 cubic meters.

### OWNERSHIP OF LAND IN CULIACAN VALLEY BY AMERICANS.

A survey of the land owned by foreigners in the Culiacan Valley shows that a total of approximately 150,000 acres are owned by Americans, in parcels running from 19,000 acres down to 90 acres. With the exception of some 19,000 acres, all this land comes under

FIG. 11.—FIVE UNDERGROUND TUBES 7 FEET IN DIAMETER FROM INTAKE AT RIVER TO WATER CURTAIN OF CANAL "ROSALES," CULIACAN VALLEY.

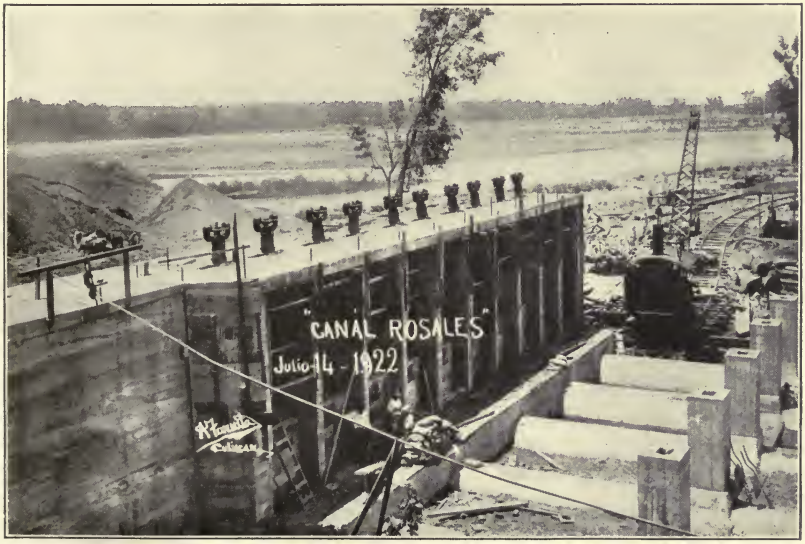


FIG. 12.—HEAD GATE AND UNDERGROUND TUBES WITH AIR VENTS, CANAL "ROSALES."

FIG. 13.—NEW GOVERNMENT BUILDING, MEXICALI.

FIG. 14.—MAIN IRRIGATION DITCHES NEAR MEXICALI.

this new irrigation system which has been paid for by the Mexican Government for the people of the district. In fact, American investors own about one-half of the best arable alluvial lands of this valley and (including two fairly large tracts) 75 per cent of the lands coming under this new irrigation system.

This land was acquired by American investors, principally from southern California, prior to 1910, at the time the railway was being constructed down the coast from Guaymas. With the exception of a few small tracts, all of this land was purchased in large lots for speculative purposes, it being the intention of the buyers to subdivide it and resell it to small investors and American farmers interested in getting lands of high quality more cheaply than they could be secured in the United States under similar conditions. Up to the Madero revolution in 1911 the work of subdivision and sale was well under way in the Culiacan Valley, and it was only a question of time until this valley would have had a large American agricultural colony. The series of revolutions in Mexico since then has put a stop to this development, and to-day there are not more than two or three American farmers in this valley.

### LEGAL STATUS OF LAND TITLES IN CULIACAN VALLEY.

The problem faced by the American owners of the lands in the Culiacan Valley, as well as in the other potentially rich valleys of the West Coast, may be said to be one of nonresident ownership and also that of overcoming the effect of 11 years of disturbed conditions in the country. Subdivision 1 of Article 27 of the Mexican Constitution of 1917 (Carranza Constitution) contains wording of so positive and vigorous a nature that no doubt can be entertained as to its meaning or interpretation. Foreigners are prohibited from owning land (real property) within a zone of 50 kilometers from the seacoast, the zone constituting a strip of territory approximately 31 miles wide along the coast and embracing the bulk of the best lands in the various river valleys, in nearly all of which Americans have been heavy investors in lands. As the Culiacan Valley is about 37 miles long from its apex to the seacoast, nearly all of the American land holdings come within this prohibitory provision. No attempt has yet been made in this district by the Mexican Government to make this provision retroactive, nor have the provisions of the new agrarian law been applied in any case in the Culiacan Valley to the property of either natives or foreigners since Gen. Angel Flores has been governor of Sinaloa. However, titles of lands resold to small investors can not be given under the new Constitution. Long-term leases can be given to foreigners or title can be held by foreigners without renouncing their citizenship if it is held under the name of a Mexican company duly incorporated in Mexico.

The situation presented for both natives and foreigners alike is one of impossibilities. The natives can not purchase the lands from the Americans, because they lack sufficient capital. There is not enough labor in the region to work all the lands that can be put under irrigation. The American landowners can not realize their original plans to subdivide and sell these lands in small allotments to immigrant farmers on account of the provisions of the Constitution of 1917 which prohibit ownership of these lands by foreigners. In

the meantime it is fully realized by the constructors of the Canal Rosales that it will take many years to bring the valley's irrigable lands under intensive cultivation, with the present means at hand, without foreign agricultural immigration of some kind.

### TECHNICAL DATA ON CANAL "ROSALES."

The main canal has a water-supply capacity of 33 cubic meters (1 cubic meter = 1.3 cubic yards) of water per second during 120 days of the year from July until October, and of 15 cubic meters per second flow during the period from November to February. The total annual capacity is estimated at 497,664,000 cubic meters, from which is deducted 25 per cent for absorption and evaporation, leaving a total of 373,248,000 cubic meters for the year's water supply for the land, sufficient to cover a total surface of 62,000 hectares at the rate of 6,000 cubic meters per hectare.

The main canal is 13 kilometers long, running from Culiacan to near the town of Culiacancito on the railway, where it divides into two main branches—the South Canal, which turns to the south following the general course of the Culiacan River, and the North Canal, which turns slightly to the northwest after leaving the point of bifurcation.

The excavation record for the main canal was 904,000 cubic meters of earth and 30,000 cubic meters of rock at a total cost of 667,000 pesos. The South Canal required 776,800 cubic meters of excavation, at a cost of 372,800 pesos. The North Canal required 647,900 cubic meters of excavation, at a cost of 305,400 pesos. The auxiliary canal required 420,000 meters of excavation, at a cost of 201,600 pesos.

The main canal is 15 meters in width at the top, with a slope in the proportion of 1½ to 1. The intake is of concrete on bedrock at the river, and the valves discharge the river water into a battery of five underground tubes of reinforced concrete 7 feet in diameter, which carry the water under a low depression near the river for a distance of 700 meters in two slight curves, these tubes having a combined capacity of 31.5 cubic meters of water per second with the water level of the river to the top of the intake valve doors, of which there are two for each tube, whereby the flow of water in the canal from the river can be easily and adequately regulated and controlled at all times. The intake head-gate structure is so designed and constructed that the river, in heavy flood, can completely cover the gate structure without causing damage or disturbing the functioning of the canal. The tubes connect with a water curtain of brick, where the main canal begins; this also prevents flooding of the main canal during high water.

One of the main features of this canal designed and constructed by native Mexican engineers is a desilting chamber located about halfway down the main canal. This chamber is so designed as to take the water against a curtain having a fall of 4 meters on the lower side of discharge into the canal again, breaking the flow current of the water and causing settlement of the silt, which would eventually make frequent cleaning of the canal necessary. As settlement occurs in the chamber, the mud is collected by a series of large "riffles" in the bottom—placed at angles and on an incline like the riffles in a concentrating appliance used in mining practice—which lead into an underground chamber from which an overflow current washes it out into the canal discharging back into the river, this cleaning canal being designed with a heavy incline for flushing purposes.

At Culiacancito the South Canal has a large underground siphon which takes the water over a low depression formed by an old flood channel of the river. This piece of work has not yet been completed.

The diversion dam just above the intake and just below the junction of the Tamazula and Humaya rivers, 1 kilometer from the intake, also has not been constructed yet. Considerable work still had to be done on structures such as water chambers (for discharging into lateral canals), bridges, roadways, etc., and it was very doubtful whether the canal could be used in time to be of service for the irrigation of tomatoes during the 1922–23 season, since transplanting to the fields from seedboxes takes place late in October and early in November. Several of the tomato growers of the Culiacan Valley had already provided means of irrigation by pumping, as a precaution in case the canal should not be finished in time for use for that season.

### POLICY OF AMERICAN LANDOWNERS IN CULIACAN VALLEY.

At present owners of large tracts of land in the Culiacan Valley coming under the new irrigation system of the Canal Rosales show indifference to the important matter of supporting the canal, when, for their own best interest, their policy should be one of hearty support and cooperation, manifested by taking up their proportion of the water company's shares.

## FOREST PRODUCTS.

The forest products of the West Coast include hardwoods, dyewoods, the coquito, or "cohune," oil nut, candalilla wax, and several minor products which are not exported and which have no organized industry.

### COQUITO NUTS.

The coquito is the same variety of palm oil nut called "cohune" in Central America. It contains a very high percentage of vegetable oil of high grade. Experiments have fixed the percentage of oil extraction from this product at 60 to 65 per cent of pure oil by weight, but, with the present crude methods of extraction, only 50 to 55 per cent is actually obtained from the raw nuts. The oil is principally used for the manufacture of soap in Mexico, for candle making, and, in some regions, for oil lamps.

In the southern part of the State of Jalisco, district of Purificacion, about 200,000 kilos of coquito nuts (1 kilo = 2.246 pounds), valued at 0.20 peso per kilo, are produced in a zone about 20 kilometers square (1 kilometer = 0.62 mile) without cultivation or a systematic method of gathering and oil extraction. The resulting oil is estimated at 116,667 kilos. The district of Coalcoman, in the State of Michoacan, contains some 900,000 coquito-nut palms, but, on account of the lack of an organized system for harvesting and marketing this natural crop product, only about 8,000 kilos of the nuts are obtained annually. It is reported that 129,600 kilos of coquito nuts are produced annually in the district of Tabares in the State of Guerrero, this trade being handled through the port of Acapulco.

The State of Nayarit also possesses large natural plantations of the coquito palm, the heaviest growth being found near the coast north and south of the port of San Blas, where they are gathered by the natives and Indians who inhabit this section and with whom there has been recent trouble growing out of the agrarian law in Mexico, the Indians claiming possession of the land on which these palms grow wild. Late in 1922 large areas were destroyed, or badly damaged, through these Indians setting fire to the forests in retaliation for the refusal of the local State government to turn over to them, as community property, the lands containing these natural plantations.

The nuts are not exported to the United States but are used locally for soap making, there being a number of local soap factories that pay a higher price for the oil, or the nuts, than can now be obtained in any export market. Prices for the year 1922 fluctuated between $0.085 and $0.325 United States currency per kilo for the kernels at Mazatlan, Acapulco, and Tepic, where soap factories are located.

The method employed in the extraction of the kernel from the hard and fibrous nut is extremely crude, consisting of abrasion between two rocks. Machinery for this purpose, especially if designed for hand power or draft-animal power, would enjoy a fair demand in the Nayarit district.

The entire production of coquito nuts throughout the West Coast in the States of Nayarit, Jalisco, Michoacan, and Guerrero is estimated at about 5,000 tons annually, valued, at present rates, at from $150 to $250 per metric ton, delivered at railway or seaport. Ten years ago, before the value of the oil was recognized by soap makers, the price was as low as $40 per ton.

The Indians of the coast region of Nayarit gather only sufficient quantities of the nuts in season to supply their small necessities of life, and local soap makers can not, at times, get enough of the kernels to meet their demands for the oil. The organization of this natural industry and the application of modern methods of forestation would undoubtedly result in an increased, uniform, and permanent supply of this valuable vegetable oil, which could be exported at excellent prices to the United States.

Following is a list (with location) of coquito oil producers in Nayarit:

[1 kilo=2.2046 pounds.]

| Name of proprietor. | Hacienda. | Annual average production. |
|---|---|---|
| | | *Kilos.* |
| Gonzalez, Constancio | Sta. Cruz and Teacapan | 150,000 |
| Menchaca, José O | Los Sauces (oil mill) | 100,000 |
| Cía. Agrícola de Barnett | San Lorenzo (Cañada Hacienda) | 100,000 |
| Romano (Leopoldo) & Cía | Navarette | 100,000 |
| | La Palma | 150,000 |
| Delius y Cía | Ixtapa (oil and soap factory at Miramar, La Palma). | 200,000 |
| Leo, Alejandro de | Las Varas | 150,000 |
| Maisterrena, F. é Hijos | La Lima | 60,000 |
| Romero, Eduardo | Jaltimba | 350,000 |

NOTE.—250 kilos of the raw nuts produce 138 kilos of oil by hydraulic pressing in extraction, or 55 per cent by weight. Total annual production of 900,000 kilos of oil in Nayarit, valued at $225,000 United States currency.

## COCONUTS.

Coconuts are not produced in sufficient commercial quantities on the West Coast of Mexico to permit the exportation of copra. Small plantations exist near Mazatlan, in Nayarit, in Colima, and in the neighborhood of Acapulco (State of Guerrero), where the local soap factory has had to import copra from the United States (San Francisco) in recent years to take care of its needs for soap making, the local production not being sufficient. There undoubtedly exists an opportunity in coconut production on the West Coast.

## HARDWOODS.

Very little lumber is cut anywhere on the West Coast of Mexico, and only for local use, the demand being very small. Small stands of pine and oak exist in Sonora, but they are far removed from transportation, and the large mining companies all import their materials for timbers, mine support, construction work, etc., as do also the various railways, although the Southern Pacific has been using native hardwood ties in Sinaloa and Tepic. Recent tie contracts in Sinaloa for the railway totaled 400,000, at prices ranging from 1.30 pesos for third class to 2.50 pesos each for first class. The cost of native woods has increased by 20 to 25 per cent within the last few

years on account of the increased distance of the cut from the railway and centers of population. At Mazatlan there is one firm importing California redwood and fir. Mazatlan imported a total of 341,195 board feet in 1918 and 278,482 board feet in 1919, and since then imports have increased. The native lumber production for the States of Sinaloa and Nayarit is estimated to be about 65,000 board feet for the domestic demand, used principally in house construction, for rafters, doors, windows, etc., and for furniture making. At Quila, on the San Lorenzo River, there is one small sawmill operated by a traction engine, which turns out a small quantity of native cedar boards for furniture making.

Some two years ago an American firm of Nogales, Ariz., began importing Mexican cedar and mahogany logs from the northern part of Nayarit, where good stands of these woods, especially cedar, are found. The logs are manufactured into cigar-box material, interior finish, trim, etc., and an excellent demand has been found for the mill output. Sufficient logs have to be imported and stored during the dry season, because labor is engaged in corn planting during the rainy season in the region from which the logs come, and, also, transportation to the railway would be impossible in the wet season, as there are no roads.

The ministry of agriculture and fomento (development) of the Mexican Government, through the offices of the general agents, are empowered to issue special permits for lumbering operations under the Government's new policy of forest conservation. The following translation of such a permit (dated at Mazatlan, September 21, 1922) is given below:

PERMIT FOR LUMBERING EXPLOITATION.

The owner of the land will make use of only the woods most suitable for the manufacture of railway ties, which in the region are known as "cuate," "tepeguaje," "mesquite," "tepemesquite," "cacaguananche," "guinolo," etc., preserving the forest species applicable to other more remunerative uses, such as ebony, mahogany, cedar, "mora," brazil wood, "primavera," "trucha," "guayacan," etc., which are considered as precious woods.

The proprietor will also preserve, among the species suitable for crossties, 25 trees per each hectare (2.47 acres) of the most vigorous and better-formed trees, to be marked with chalk, with the object that these trees shall serve as a means of propagation and conservation of these varieties.

The proprietor of the land will proceed to classify all precious woods before starting the cut, marking each tree with chalk, in order to prevent their being cut down during the exploitation of the area in question.

All trees which measure less than 25 centimeters (0.82 foot) in diameter at the height of a man should be preserved and not cut down, as these have not yet reached a merchantable age.

This authorization will be valid only until December 31, 1922.

The permissionaire is obligated to show the forest inspector designated by this office the area of the cut in order that the latter may assure himself that the work is being carried out in accordance with the provisions of this permit.

The interested party will make to this agency at the termination of this permit a report which will contain the amount of the product cut and the value realized therefrom.

This lumbering permit may be revoked or canceled at any time by the Secretary of Agriculture and Fomento (Development), and also by the agent issuing it, in the case of the failure of fulfillment of these conditions, or on account of the issuance of any new regulations which may further govern forest exploitation.

Consul W. E. Chapman, of Mazatlan, has furnished a report on the commercial woods of his consular district, which comprises the States of Sinaloa and Nayarit, embracing some 25,000 square miles.

Many varieties of both hard and soft woods are found in large quantities in the mountainous regions, but the lack of transportation prevents the profitable marketing of this timber except in a few sections. On the seacoast plains and the foothills of the mountain ranges parallel to the coast line the timber is rather small and sparse. In recent years large shipments of dyewoods have been sent from Sinaloa to New York, but most of these woods that were easily accessible to railways and seaports have been cut away, and wood cut in the interior must be transported on the backs of burros, reducing the profits on this trade. Considerable quantities of dyewoods, as well as ebony and other hardwoods used for furniture, are now being cut and used for fuel at mines and plantations where other fuel is scarce.

Local authorities believe that success in the lumber industry can be obtained only by the operation of a small, portable sawmill, which could be moved about to the different sources of supply within the limits of reasonable transportation facilities. Fancy hardwoods have never existed in dense forests in the Mazatlan section. Several firms have failed in the business of cutting and exporting hardwood logs from the Mexican West Coast, and the principal cause assigned for their failure was overinvestment of capital in stationary machinery and other equipment.

One of the possibilities in this connection is the establishment of a plant to produce common lumber for the local demand. A native wood much used is the amapa boba, which is employed for wheel spokes and axles for carts and wagons, as well as for shovel handles and similar purposes. The Mexican Government, through the department known as Agencia General de Agricultura y Fomento, at Mazatlan, had undertaken some interesting research work on the native woods. The results of this study have been embodied in a series of bulletins.

A promising tract of timber, chiefly Spanish cedar, was reported a few miles from the coast line below San Blas, Nayarit, the timber extending southward into the State of Jalisco. Another tract was found in Tepic City, where the altitude is about 4,000 feet. This tract contains several species of trees, including pine, oak, spruce, and cedar. The construction of the Southern Pacific Railroad through the Mazatlan consular district absorbed a large part of the timber on either side of the line. Moreover, the railway opened up the country to local industries with incidental lumber requirements and provided transportation for the timber cut within reach of its stations.

Two specimens of each of the 31 common varieties of woods found in the Mazatlan consular district were sent in 1918 from the American consulate at Mazatlan to the Bureau of Standards at Washington for technical tests. The results of the bureau's analysis of the first 12 of these species of seasoned timber are shown in the table below, the technical data on the remainder having been omitted because of the comparatively small quantities available of the other 19 varieties. However, the tests of the entire series are on file at the Mazatlan consulate. It will be noted that certain variations exist in specimens of the same variety of wood. They were subjected to identical tests, but the Bureau of Standards points out that specimens of the same species often vary through a considerable range, because of imperfections in the wood or conditions under which the tree was grown.

| Specimens. | Rings per inch. | Moisture content. | Weight per cubic foot, air dry. | Static bending. | | |
|---|---|---|---|---|---|---|
| | | | | Fiber stress at elastic limit. | Modulus of rupture. | Modulus of elasticity. |
| | *Number.* | *Per cent.* | *Pounds.* | *Lbs. per sq. in.* | *Lbs. per sq. in.* | *Lbs. per sq. in.* |
| Amapa | 13 | 10.35 | 53.63 | 10,920 | 16,242 | 1,710,000 |
| | 13 | 10.79 | 50.39 | 10,680 | 16,027 | 1,686,000 |
| Arrayan | 24 | 12.56 | 62.80 | 7,300 | 12,055 | 1,595,000 |
| | 24 | 12.48 | 57.47 | 6,410 | 12,300 | 1,713,000 |
| Cedro Colorado | 21 | 11.02 | 29.69 | 6,270 | 10,444 | 1,082,000 |
| | 21 | 11.00 | 26.93 | 4,350 | 6,949 | 1,252,000 |
| Ebano | 20 | 13.37 | 76.78 | 13,400 | 20,000 | 2,240,000 |
| | 20 | 13.51 | 77.10 | 5,180 | 5,642 | 1,190,000 |
| Guanacastle | 7 | 9.37 | 18.40 | 2,080 | 4,580 | 345,000 |
| | 7 | 9.41 | 18.22 | 2,360 | 4,696 | 394,000 |
| Haba | 12 | 9.319 | 24.84 | 2,717 | 5,780 | 1,145,000 |
| | 12 | 10.724 | 22.66 | 4,155 | 6,942 | 1,082,000 |
| Mauto | 14 | 10.51 | 58.92 | 9,420 | 11,752 | 1,774,000 |
| | 14 | 11.58 | 58.33 | 9,570 | 14,000 | 1,995,000 |
| Mesquite | 8 | 9.60 | 61.60 | 8,800 | 11,930 | 1,243,000 |
| | 10 | 10.22 | 56.22 | 8,000 | 12,685 | 1,422,000 |
| Mora | 10 | 10.02 | 52.87 | 15,750 | 24,300 | 2,060,000 |
| | 10 | 9.68 | 58.28 | 13,750 | 17,045 | 1,827,000 |
| Palo Colorado | 22 | 10.64 | 59.76 | 10,930 | 15,944 | 2,002,000 |
| | 22 | 10.65 | 61.31 | 10,130 | 14,478 | 1,775,000 |
| Palo Fierro | 25 | 13.25 | 63.85 | 8,060 | 21,300 | 1,410,000 |
| | 25 | 13.45 | 64.56 | 8,670 | 15,606 | 2,379,000 |
| Venadillo (Ocaova) | 20 | 10.67 | 42.52 | 9,760 | 12,305 | 1,535,000 |
| | 20 | 10.73 | 45.72 | 9,000 | 8,969 | 1,450,000 |

| Specimens. | Rings per inch. | Compression parallel to grain. | | | Hardness.[1] | |
|---|---|---|---|---|---|---|
| | | Fiber stress at elastic limit. | Modulus of elasticity. | Maximum crushing strength. | End. | Side. |
| | *Number.* | *Lbs. per sq. in.* | *Lbs. per sq. in.* | *Lbs. per sq. in.* | *Pounds.* | *Pounds.* |
| Amapa | 13 | 4,790 | 1,320,000 | 8,575 | 2,480 | 3,140 |
| | 13 | 4,850 | 1,174,000 | 8,940 | 2,185 | 3,040 |
| Arrayan | 24 | 2,462 | 692,500 | 7,580 | 2,800 | 2,800 |
| | 24 | 2,650 | 616,000 | 6,000 | 3,000 | 2,700 |
| Cedro Colorado | 21 | 4,700 | 945,000 | 6,392 | 770 | 730 |
| | 21 | 4,190 | 945,000 | 6,165 | 725 | 790 |
| Ebano | 20 | 7,990 | 2,040,000 | 13,580 | 2,540 | 3,900 |
| | 20 | 9,985 | 2,190,000 | 14,350 | 3,400 | 3,530 |
| Guanacastle | 7 | 1,480 | 388,000 | 3,555 | 350 | 390 |
| | 7 | 1,315 | 3,215,000 | 3,310 | 430 | 390 |
| Haba | 12 | 2,435 | 634,000 | 4,545 | 840 | 630 |
| | 12 | 2,500 | 604,000 | 4,595 | 570 | 470 |
| Mauto | 14 | 6,700 | 1,325,000 | 9,970 | 3,670 | 3,000 |
| | 14 | 6,410 | 1,315,000 | 10,910 | 3,320 | 3,370 |
| Mesquite | 8 | 5,330 | 1,109,000 | 9,600 | 2,360 | 3,220 |
| | 10 | 5,800 | 1,197,500 | 8,640 | 2,350 | 2,660 |
| Mora | 10 | 7,820 | 1,906,000 | 14,620 | 2,600 | 3,100 |
| | 10 | 10,810 | 1,786,000 | 14,470 | 3,300 | 3,560 |
| Palo Colorado | 22 | 3,845 | 1,027,500 | 5,780 | 2,930 | 2,590 |
| | 22 | 5,880 | 1,656,500 | 9,140 | 2,720 | 3,020 |
| Palo Fierro | 25 | 7,010 | 1,764,000 | 11,630 | ..... | 2,780 |
| | 25 | 6,666 | 1,606,000 | 11,600 | 2,840 | 3,700 |
| Venadillo (Ocaova) | 20 | 5,670 | 1,343,000 | 8,360 | 1,390 | 1,340 |
| | 20 | 4,950 | 1,505,000 | 8,415 | 1,580 | 1,400 |

[1] Load required to embed an 0.444-inch ball to one-half its diameter.

An abundance of oak firewood is reported by Consul F. J. Dyer, of Nogales, in the State of Sonora, at a place called Vigia, formerly known as Cos, 55 miles south of Agua Prieta. This oak timber covers a hilly region 3 or 4 miles wide by 30 miles long, extending from Calabasas to Fronteras. Notwithstanding the large amounts of oak wood already cut and shipped, quantities still remain in the

Vigia region, though it can no longer be found within 5 miles of the railway. Some cedar and pine are found also on the mountain slopes around Vigia. Considerable quantities of these woods are shipped from Agua Prieta, Cananea, and Nogales to the United States.

### DYEWOODS.

The dyewoods found on the West Coast include "mora" (which produces the yellow vegetable dye of commerce), brazil wood, and fustic. Small quantities have been cut and exported for many years during the dry season, the largest exports formerly going to Germany and latterly to the United States.

During the early months of 1918 a considerable amount of brazil wood and mora wood for dye purposes was exported from the West Coast to the United States, but since that time very little attention has been given to cutting and exporting these woods for commercial purposes. It is reported that it is now very difficult to secure contracts for the delivery of these woods at the railway or port of call for steamships at a price that will permit a profit, on account of the fact that nearly all of these woods that were easily accessible to the railway or seaports have been cut away in past years.

A considerable amount of both brazil and mora wood may be found in widely scattered localities in the foothill areas of the interior, but transportation is lacking. Much of these valuable woods, together with even ebony and mahogany, has been used in the past for fuel at the various mines in the district.

An American citizen residing at Culiacan has installed a small experimental plant at La Cruz, Sinaloa, for the extraction of brazil and mora dye material and also for the preparation of the wood in granulated form for shipment to New York. The machinery of this new plant has a capacity of about 1,500 tons per month.

Fustic is found almost everywhere on the West Coast, but the "palo brazil" is becoming rather scarce in recent years, as it is much used locally for fuel.

In 1920 the Southern Pacific Railroad of Mexico made a rate of $1.20 per 100 pounds (with a carload minimum of 40,000 pounds) for the exportation of dyewoods from the West Coast to New York via New Orleans. The steamer rate to New York was $28 per ton measurement. New York and Pennsylvania market quotations, f. o. b. cars New York, or Pennsylvania points, were recently as follows: From $32 to $36 per ton for mora; $42 to $46 per ton for campeche wood; and $45 to $50 per ton for palo brazil. Mexican export duties amount to 0.50 peso per 100 kilos of gross weight (1 kilo = 2.2046 pounds). The expenses of each carload, exclusive of freight, amounts to about $26 United States currency.

Fustic is the trunk wood of *Morus tinctori*, indigenous to the West Indies, Mexico, and South America, and found chiefly in Central America and on the coasts of Mexico. It contains two coloring principles, morin and moric acid, which occur in the wood combined with lime and maclurin or moritannic acid, both of which are yellow dyes and are contained in the commercial extract. While fustic has been largely replaced by azo and anthracitic colors, it is still used for wood dyeing.

During the calendar year 1921 a total of 581 tons of brazil dyewood, the declared value of which was $10,766, was exported to the

United States through Nogales, Ariz. In 1920 the corresponding amount was 1,783 tons, valued at $36,661. Mora dyewood sent to the United States through the same port in 1921 amounted to 380 tons, valued at $9,288, while in 1920 the amount was 37 tons. During the first six months of 1922, Nogales imported from the West Coast of Mexico a total of 1,210 tons of brazil dyewood, valued at $20,738. Mora dyewood sent to the United States from the West Coast region through the same port during the same period amounted to 1,675 tons, valued at $30,414.

There were no declared exports of dyewoods to the United States from Mazatlan, the commodity going to eastern markets via Nogales and New Orleans.

For figures on the exportation of forest products, the reader is referred to the tables of exports in Supplement to Commerce Reports No. 20, Trade and Economic Review for 1921, Mexico.

## FISHING INDUSTRY.

Various investigations and surveys in the past have shown that the waters of the Gulf of California abound in several valuable varieties of food fish. It is also a fact that the fishing banks off the Pacific coast of the peninsula of Lower California furnish 90 per cent of the fish used in the canneries located at San Diego and San Pedro (the port of Los Angeles). Shrimp fishing has long been one of the established industries at Topolobampo and south of Mazatlan at Esquinapa and San Blas. Oyster beds are found at Guaymas and on Altamura Island near the port of Altata, near Culiacan. Several attempts have been made to establish canneries for fish packing, one at Guaymas, another at Topolobampo, and two on the Pacific side of Lower California, where one factory has recently been moved to a new location, from San Quentin Bay, south of Ensenada, to Cedros Island, lying offshore. Pearl fishing has been conducted for many years at La Paz, Lower California, under exclusive concessions from the Mexican Government, but these concessions have now been declared void and fishing is free for all who may engage in the industry, all that is required by the authorities being a permit, or fishing license, for which a reasonable fee is paid.

There is a very small market on the West Coast for fish and fish products on account of the small population, but the more densely populated centers of the interior of Mexico are taking increasingly large amounts of canned and dried fish, and, in view of the heavy import duty into Mexico, a domestic cannery and drying plant ought to prove a profitable investment and industry, although, for various reasons, efforts in this direction on a small scale have failed so far.

It is also claimed by fish canners that the fish from the Gulf of California contain too much phosphate, causing the bones to harden and the flesh to soften in the process of canning.

Guaymas ships about 100 pounds of fresh fish per day to the border at Nogales for local consumption there. In the gulf, climatic conditions are not considered favorable for fishing operations, as periods of calms and extreme heat affect the runs of the fish in season. Throughout the northern half of the gulf the coasts on both sides are very arid, fresh water is scarce, and there are few good small harbors, the waters of the gulf being considered unsafe for boats of less than 50 tons. Also, there are no supply stations for fuel for motors, food for crews, or tackle needed, all of which would have to be brought down from the United States, although gasoline can be had at Guaymas, and No. 1 engine distillate, most used in fish-boat engines, would be carried by dealers if there was a demand for it.

### COMMERCIAL FISHES OF WEST COAST.

In 1921 San Francisco fish-packing interests sent two specially equipped seine boats to the Gulf of California to make a complete and scientific survey of the fishing possibilities of the waters of the gulf

from Mazatlan and La Paz to the mouth of the Colorado River, so the fishing possibilities of the West Coast are well known to American packers interested in this development of industry. The survey mentioned has not as yet resulted in the establishment of canneries anywhere on the West Coast, such attempts having been made by individuals with small capital and limited resources.

A. Russell Crowell (now deceased), who was an American resident of Mazatlan and an authority on fish, particularly those in local waters, prepared a report entitled "Commercial fishes on the Mexican West Coast." The report sets forth many salient facts of value to those interested in fish products.

For some time prior to the late revolution in Mexico, says Consul W. E. Chapman, a fish cannery of fair importance operated to the south of Mazatlan, where several varieties of fish were preserved and considerable oil and fertilizer realized from other varieties and the by-products.

Fish are so plentiful in these waters that it is a common sight to see men catching them with loose lines in the surf across the street 200 feet from the Mazatlan consulate windows, or to see sardines flipping out of the water by the hundreds in their efforts to escape the larger fish that prey upon them; sea birds gather at the scene of the disturbance and in a few minutes each morning catch as many of the little fish as they want. Mr. Crowell's report follows, in part:

### MULLET MOST ABUNDANT.

More than 100 species and subspecies of fish exist within a radius of 60 miles from the city of Mazatlan, exclusive of shellfish and crustaceans, though only about 40 of them are of any great commercial value and not more than 20 can be shipped or canned in any large quantity. The most abundant is the mullet, locally known as lisa, and in Hawaii as ama-ama. There are two varieties of mullet, the striped mullet (*Mugil cephalus*) and the white mullet (*Mugil curema*), known here as bolaina. The striped variety grows to 27 inches in length, 4½ inches across the back, 7 inches deep, and weighs 7 pounds, but fish of this size are rare. They vary greatly in color, and a single school has been seen with lemon-yellow, black, blue, and green backs, sides silvery. They enter the lagoons and esteros (inlets) from the sea in July and August, or as soon as the rains have swollen the rivers. They spawn in December and January and feed on a fine moss called lama, and consequently do not take the hook. They are caught in seines, traps, and with a native casting net called a tarraya, but they are difficult to catch in seines, as they jump over the cork line. In Mexico the natives place canoes around the seine for the fish to jump into, and in Hawaii the fishermen are very expert in catching them in hand nets as they jump over. They are excellent eating when fat, can well, and are very palatable either smoked or dried. They are unknown commercially in the western waters of the United States, except to a limited extent at San Diego, Calif., where schools of small white mullet are sometimes seen.

The white mullet or bolaina is even more abundant than the striped variety, but is a much inferior fish and rarely grows to more than 16 inches in length. They spawn in April and May and again in September. The roe is delicious, greatly resembling shad roe. It is marketed at Mazatlan, salted and dried.

### MILKFISH—FOUR VARIETIES OF ROBALO.

The robalo or milkfish (*Chanos chanos*), known in Hawaii as the awa, is also very abundant, but, unlike the case of the lisa, the runs are very erratic. In some years they are very numerous, in others very scarce. In some seasons a 24-inch fish is a big one, while in others 50 to 60 inch fish are common. They are a beautiful, extremely active, delicate fish. Some writers call them the Pacific shad, but this is a misnomer, as the lateral line is well defined. The natives eat them only when dried, and they are of excellent flavor but bony. Like the mullet, they are vegetarians and often run in the same school. They spawn in July and should prove a valuable fish for export, either smoked or dried.

The robalo (family of Oxylabracidae) is one of the most common fish on this coast and one of the most valuable. Four distinct specimens are known locally as: Robalo neto, robalo garivato, robalo peleto, and constantino. The robalo neto is the largest of the family, growing to 50 pounds weight, and is more heavily built and darker in color than the other varieties. The garivato is similar, but lighter in color and more slender. Both have white, firm flesh and when dried are very similar to codfish—in fact, when they are properly cured, only an expert can distinguish them from codfish. When canned they are not very attractive, but either fresh or dried should find a good sale in the United States. The peleto is a much smaller fish, not often exceeding 24 inches in length and with much softer meat. If cured in the Chinese method they are preferred by the Chinese and bring from 8 to 14 cents per pound wholesale in the San Francisco (Calif.) market. The constantino is a delicious pan fish, not often more than 14 inches long. They are very numerous in the esteros (creeks) south of Mazatlan. All of the family are voracious feeders, devouring all small fish, shrimp, sardines, etc. They do not run in schools like mackerel or herring, but are sufficiently numerous to catch, and it is not uncommon to get 100 or more at a cast of a small seine.

### FIVE VARIETIES OF CORBINA (WEAKFISH).

The corbina ranks next to the robalo in commercial value. This fish is a branch of the family of croakers (Sciaenidae, genus Cynoscion, weakfishes). There are five species on the West Coast: Yellow corbina (*Cynoscion reticulatus*); Gulf of California white sea bass or tortuava (*Cynoscion macdonaldi*); California bluefish, known locally as chalangandina (*Cynoscion parvipinnis*); white corbina or California sea trout; and the corbina prieta or gray corbina, not classified.

The entire family is very similar in appearance and habits; only a scientist can tell the difference in some species. They enter the creeks from the sea in July and August to spawn, and, with the exception of the tortuava, they run in immense schools. Two men in a canoe will often catch from 200 to 300 at a time with hand lines and several thousands in a few casts of a small seine.

The tortuava grows to 172 pounds (the record catch), but the other varieties average 2 or 3 feet in length. The first runs are generally about 18-inch fish. They are rather light for frying in the American style, but are the favorite fish of the Chinese and bring about the same price in the San Francisco market as the robalo when cured by the native Chinese method.

Of the other members of the croaker family, the yellow-fin roncador or berrugate (*Umbrina sinaloae*) and the boca dulce (genus Bairdiella) are very numerous. They are excellent pan fish and would be of great value in any market, fresh or iced, but are too small for frying. The kingfish or whiting (*Menticirrhus elongatus*), frequently called berrugate by the natives, run with the corbina. They are soft-meated and when dried are very thin.

#### PARGOS (SNAPPERS), CABRILLA (SEA BASS), AND MERO (SPOTTED JEWFISH).

The pargos or snappers are nearly as numerous as the corbina and, not being as migratory, can be secured almost any month in the year. The pargo colorado (*Lutianus colorado*) is well known in the United States as the red snapper and on the east coast of Mexico as the guachinango. This is a very superior table fish and cans splendidly, the meat being white and firm. They can be found in the ocean all along the coast, but are more numerous in the esteros (creeks) in January and June. They are fine game fish, as well as valuable fish commercially, taking the trolling spoon or live bait. The same description applies to the other species of the snappers found on the West Coast, of which there are six, five being known to science.

The gray snapper, pargo prieto (*Lutianus griseus*), is almost as common as the red variety and grows to 50 pounds weight. The yellow or rock snapper, the pargo flamenco or calandria (*Lutianus gutatus*), and the pargo raicero (*Lutianus aratus*) are smaller species, not often more than a foot in length.

One of the most popular fishes in the market is the cabrilla (*Paralabrax maculatofasciatus*), one of the sea basses. They range from Guaymas to the State of Nayarit, being more plentiful about Guaymas than at Mazatlan. They grow to 32 inches and are fine-flavored and very game. Another of the bass family of great commercial value is the mero or spotted jewfish (*Promicrops itaiara*), a golden-brown fish with black spots—the older fish being of a solid gray. Unlike the jewfish of California, they are excellent eating. The meat is white and firm though slightly flaky. They are caught principally by the hook and line—also often in the seines when set for robalo or corbina. They can be found among the rocks, and enter the esteros to spawn in early summer. Their weight is up to 400 pounds, and 150-pound fishes are common.

#### SALT-WATER BREAM, POMPANOS, AND BUTTERFISH.

There are two varieties of the rudder fish in these waters, but the chopa or salt-water bream (*Kyphosus elegans*) is the only one worthy of note. It grows to a length of 18 inches and to a weight of 5 pounds. These fish are well flavored but not very plentiful.

The pompanos are well represented here by 10 species, not including two species of butterfish. Some are new to science, and some, according to Professors Jordan and Evermann, belong to the Atlantica only and must have come through the Panama Canal; others are well known. Among them are the cavella or toro (*Carangus hippos*), to 30 pounds; the yellow-tail or amber fish, to 40 pounds; the Pacific moonfish or caballo (*Selene aerstedii*), to 12 inches; the common moonfish or jorobado (*Vomer septipinnis*), to 12 inches; the round pompano or palometa (*Trachinotus kennedy*), to 27 inches; the silvery pompano

(*Trachinotus argenteus*), to 7 inches; the gaff-topsail pompano or paloma (*Trachinotus palometa*), to 7 inches; and the big-eyed scad, known in Hawaii as akule, in Samoa as atule, and in Mexico as the cocinero (*Trachurops crumenopthalmus*), to 7 inches.

Of the butterfish or fiatolas there are two species—the poppy fish or California pompano (*Palometa simillima*), and another that is probably *Palometa media*. With the exception of the toro, which is dark-meated and not very choice, all the above fish are delicious, delicately flavored pan fish.

#### MOJARRAS—CHIRO—SPANISH MACKEREL.

Among the smaller or pan fish one of the most popular (and, to the taste of many, equal to the pompano) is the mojarra. There are five distinct species: White mojarra or broad shad (*Xystaema cinereum*); mojarra China (*Gerres lineatus*); mojarra prieta or gray mojarra; mojarra Turca; and mojarra jorobada. They range from 6 to 18 inches in length, and are all delicately flavored, superior pan fish that would bring fancy prices in the United States, either fresh or iced.

The halfbeak, balao, or pajarito (*Hyporamphus roberti*) is a smeltlike fish that grows to about a foot in length. They are excellent eating and should can well. Continuous schools of them miles in extent have been seen. When they enter the esteros to spawn in June, a seine could not be hauled by hand without first emptying out a part of the catch.

Another very valuable fish found in these waters is the chiro or big-eyed herring, otherwise known as the piojo, Francesca, matajuelo real, or John-Mariggle (*Elops saurus*). They have been caught up to 24 inches in length. The small ones make fine kippered herring, and the large ones can be dried or smoked to good profit. They are very numerous, following up the immense schools of anchovies, shrimp, etc.

The Spanish mackerel is also plentiful. It is called here cero or sierra. The two principal species are *Scomberomorus naculatus* and *Scomberomorus sierra*. They range on both sides of the peninsula of Lower California and from Mazatlan south. They have been caught to 34 inches in length and are palatable but dry in comparison with good Atlantic mackerel.

#### SARDINES AND ANCHOVIES.

Also, countless millions of true sardines thrive in Mazatlan waters. The principal one here is the silverside (*Sardinella kowala*). In seven years' fishing a few 4-inch fishes have been seen, but they will average 3 inches when matured. The blue sardine or thread herring (*Sardinella episthonema*) is second only in numbers, and it is needless to say that here is superb canning material.

Anchovies are also abundant and bring good prices, salted and dried, dry salted in half barrels, or pickled in brine. Two species are found—the big white anchovy or sardina bocona (*Anchovia macrolepidota*), to 8 inches in length, and the little western anchovy (*Anchovia delicatissima*), from 3 to 4 inches in length. Both enter the esteros (creeks) and lagoons in immense schools in December, January, and February, and again in April, May, and June.

### SHARKS.

Sharks are very abundant; seven species are common. The natives catch a great many on hand lines and with harpoons for the livers and fins. The livers are used for shark-liver oil, while the fins are dried for the Chinese trade and always bring good prices. The bodies could be used for fertilizing material to good profit. They are sufficiently plentiful, 16 having been taken in two hauls of a net in fishing in the surf for robalo. The hammer-head is probably the most plentiful.

### SHRIMP FISHING.

During the past few years shrimp fishing at Guaymas and Topolobampo on a commercial scale has been attempted by several concerns, but all these efforts have resulted in failure. The chief difficulty seems to be the lack of a steady supply of fresh shrimps for the packing plant, the runs being very irregular and the season very short.

In late 1921 a temporary shrimp-packing plant was installed at Guaymas by a California company, but before the plant was completed it was discovered that shrimps were not available in sufficient quantities in the waters near the port. The plant was then moved to Topolobampo, near the mouth of the Fuerte River, where it was operated for a few months, without success, although shrimps are much more plentiful in those waters than near Guaymas. The Mexican customs officials insisted upon collecting an export duty of 2 cents per kilo (1 kilo=2.2046 pounds), not only on the shrimps, but also on the wooden containers in which the 5-gallon cans were placed and the ice in which they were packed, 40 pounds of fresh shrimps requiring about 100 pounds of ice for railway shipment to the border.

Experiments were made with power boats dragging nets, but the waters in which the shrimps were found proved to be too shallow, and the only practical method appeared to be that of the natives, who employ dugout canoes and small casting nets, there being about 80 canoes, with from two to three men in each, employed in the industry during the summer shrimp runs in Topolobampo Bay and adjacent waters. This port exports from 200 to 300 tons of dried shrimps annually.

Fishermen at Topolobampo receive about $0.06 per kilo (2.2046 pounds) for their catch after boiling and drying, the bulk of the catch being taken by the Chinese merchants.

The shrimps of the West Coast of Mexico are not the true shrimps but rather a species of prawn.

Following are extracts from a report by A. Russell Crowell, of Mazatlan:

> Shrimps are plentiful in many places along the coast of Sinaloa. The quantity of the runs varies greatly, as in dry seasons they do not enter the lagoons in the same numbers as in the wet seasons, and if the rains are late the natives often close the dams too early and shut out the shrimps instead of holding them in. The canners can expect about one poor year in five, but even in a poor year there is thought to be enough in the run to put up a food pack. Some nights as high as 50 tons can be taken at one trap gateway, but such runs occur only a few times during the season. About three-quarters of the run is composed of shrimps of average size, mixed with much larger ones which are good for canning, also.
>
> The shrimps enter the lagoons from the sea at the time of the first rains of the wet season, beginning early in July, or as soon as the rains have flooded the rivers. The season lasts through September and October, and at times as late as to December.

South of Mazatlan the method of fishing employed by the natives is almost entirely by traps made of split cane and set in dams that are placed across the lagoons. The shrimps enter these shallow lagoons on the new-moon and full-moon tides.

As the canoes come from the traps at night loaded with shrimps the cargoes are dumped into crude wooden vats having a metal bottom under which there is a fire for cooking the catch. After boiling, the shrimps are dried on mats in the sun and packed in mat containers for shipment. Very often at least one-half of the catch is lost because there is not sufficient provision of cooking vats and the fish soon die when they can not be used. In Mexico the shrimp are not peeled as is the Chinese fashion.

It takes nine-tenths of a pound of fresh shrimps to make one can of 4½-ounce dry pack. One case of 28 cans makes 42.85 pounds of fresh shrimps. Fifty pounds of fresh shrimps are sold in baskets by the natives at the rate of $0.03 per pound, and would peel to 16 pounds of fresh shrimps for packing. On account of the very delicate nature of the shrimps, and because of the hot climate, it would be necessary to locate a cannery very near to the selected place on a lagoon which was known to have a large run, or else means would have to be provided to collect the shrimps from other lagoons, with ice pack; and means of transportation are lacking, as boats large enough to carry several tons of shrimps could not navigate these shallow lagoons, and the only means of transportation inland is the railway, which, after touching Mazatlan, leaves the coast and proceeds toward Tepic.

## LOBSTERS.

The American "spiny" lobster is also very abundant all along the West Coast in rocky places and is caught by the natives with their hands in diving. The meat runs well up into the body and the flavor is excellent.

The white anchovy (*Anchovia macrolepidota*) is also very plentiful on the West Coast. It is as much as 8 inches in length and runs in very large schools. The small western anchovies (*Anchovia delicatissima*) are also numerous from December to June.

The West Coast also has the white sardine (*Sardinella kowala*), also known as the "silverside" sardine, rarely over 4 inches long, which runs in schools from ½ to 1 mile wide and 6 miles long, principally in May and June. They have also been caught in seines during the fall and winter months.

Both the bluefin tuna and albacore are found in these waters, but the volume of their runs has not yet been determined.

The business of exporting shark fins to China, via San Francisco, has been carried on for many years on the West Coast, but the trade is small.

## OYSTERS.

Oyster beds are abundant from Guaymas to Las Peñas, south of San Blas in the State of Nayarit. There are seven large oyster beds within 60 miles south and 100 miles north of Mazatlan. These beds are estimated to furnish from 50,000 to 100,000 cases per annum of canning oysters. It is not true that oysters from warm waters are not good. The oyster beds of the West Coast occur in great bunches, and methods of extending them would not be the same as along the eastern seaboard of the United States, since 1 acre on the West Coast would contain many more than in those waters. The season also differs materially. The oysters of the West Coast are at their best in June, and, if the wet season is late, they are often so fat in July that they can not be canned successfully. They spawn in November. In March the beds are usually too thin to pack. The class of oysters of the different beds of the West Coast differ

greatly in condition, because of variations in rainfall. Those near the mouths of the large rivers are in condition for packing before those located near to smaller streams which do not carry much fresh water until later.

The following facts are brought out in a report from the American consul at Guaymas, dated March 2, 1922:

Although there has never been a scientific investigation of the extent of the oyster beds near Guaymas, nor as to the possibilities of the conservation and propagation of the known oyster beds, it is common knowledge that the supply of oysters in the waters of the Gulf of California is almost inexhaustible between Las Guasimas, a point 11 miles southeast of Guaymas, and the island of Lobos, 40 miles from the port, the beds being usually from 4 to 5 miles apart and known by the following names, beginning with Las Guasimas: Rio Viejo, La Tortuga, Las Cruces, and Los Algodones. The beds are found in shallow water near the shore and can be worked by present methods only at low tide.

No systematic method is followed with the view of conserving the supply, such as throwing back the small, immature oysters, or endeavoring to propagate them. Neither are there fleets of small boats to keep the local market or the export demand supplied.

The fishermen proceed to the beds only when they have orders for a considerable number, or when they are driven to it from want. They do not receive a fixed wage, but work on their own account, the contractor in some cases furnishing his own boats. The rate paid for oysters at present is about 6 pesos per thousand, delivered at Guaymas, and it is difficult to find fishermen to go when the oysters are wanted. They usually quibble over the terms, the weather, the tides, etc. It is thought that a concern contemplating the establishment of a cannery would do well to have its own boats and to employ foreign fishermen.

The oysters can be gathered only at low tide when the beds are wholly or partly uncovered. They are pried loose from the rocks, thrown into rowboats equipped with sails, and brought to Guaymas, where they are put into shallow water near the shore and taken out according to the demand. The beds are worked during eight months of the year, beginning in September.

Because of the limited local consumption and the absence of a cannery, the dealers depend to a considerable extent upon shipments to interior points and to Arizona. The oysters are shipped in the shell, packed in jute sacks. Attempts have been made from time to time to ship shelled oysters in tin cans, packed in ice, without cooking, but this did not prove wholly successful.

In pre-revolutionary days oyster canneries were operated at Guaymas on a limited scale with considerable success. However, attempts made since 1918 have proved failures. In 1919 a company, composed of Americans and Mexicans, was organized at Guaymas for the purpose of establishing a general fish-packing plant, with oysters and turtles as specialties. About $20,000 was spent for machinery and equipment, but because of financial difficulties, lack of steady supply of sea food, poor marketing facilities, excessive import and export duties, and other causes the plant turned out only a few cases of goods and was then closed down and dismantled.

During the winter of 1920-21 two California men established a small oyster-packing plant at Guaymas, but it was in operation only a few months. The machinery and unsold products are now stored in a local warehouse. On account of the high import duties on many necessary materials, the high export duties on the finished products, and the difficulty in establishing favorable market connections, the venture did not prove a success.

The same obstacles would undoubtedly be met by a concern attempting to establish a packing plant to-day; and while most materials have been reduced in price it would now cost more to deliver the oysters at the plant. The firm in question was paying only 2.50 pesos per 1,000. It had also to contend with labor difficulties, being compelled frequently to suspend operations because of the failure of the fishermen to go out to the beds.

## SUMMARY.

It has been shown that many varieties of commercial fish and sea foods are abundant in the waters of the West Coast of Mexico, including shrimp, turtles, oysters, tuna fish, albacore (a species of tuna or mackerel), sardines, anchovies, lobsters, etc., and it is also a fact that the demand for these products, as well as for dried fish, is rapidly increasing in Mexico, which places a high import duty on canned and prepared food products coming into the country. It would seem that an excellent opportunity exists for the establishment of a fish cannery on the West Coast for the distribution of its products in Mexico itself. However, such attempts on a small scale in the past have been failures on account of the lack of a dependable supply, resulting from the indifference and other characteristics of the native fishermen, the excessive local taxation, the import and export duties, etc., and the general attitude of opposition toward foreign enterprise.

## MANUFACTURING.

The manufacturing industries of the West Coast territory include shoe factories, flour mills, cigarette factories, soap factories, tanneries, cotton textile mills, and the sugar mills mentioned under "Agriculture." There is also one machine shop, foundry, and woodworking factory at Guaymas, and another foundry and machine shop at Mazatlan. The largest tannery—one of the largest in Mexico—is located at La Paz, in Lower California. Small tanneries are found in many small towns throughout the interior, but these do not use machinery of any kind and only supply the local demand for sole and saddle leather of rather poor quality. The common footwear of the people of the poorer class is the leather-soled sandal called "guarache," held on the foot by leather thongs, although a larger proportion than ever before of even the poorest people of the cities and towns are now wearing shoes.

### COTTON TEXTILE MILLS.

The largest cotton textile mill, located at Culiacan, and owned by Redo y Cía., was destroyed by fire during the Madero revolt in 1911, and has never been rebuilt, although the main building still stands in fair condition. This mill turned out cotton drills, denims, and the rough, unbleached cotton cloth so much used in the country by the common people.

Two cotton mills were established in Nayarit 40 years ago by the original British owners of the great properties held to-day by the Spanish family of Aguirre, which also owns the two large sugar mills in this State. The mill at Jauja, a suburb 4 kilometers from the city of Tepic, on the Tepic River, which furnishes water power for the machinery, has been closed down since 1915 on account of a shortage of cotton in Nayarit and also on account of labor troubles and the attitude of the local State officials in supporting the operatives in their demand for a minimum wage of 14 pesos ($7 United States currency) per day of 10 hours. The first machinery of this mill and also that of Bellavista, belonging to the same estate, was originally American, but replacements have been made from time to time with British machinery, principally in 1885 and 1886, when the factories were remodeled by the present owners. The Juaja factory originally had 168 looms and now has 160 ready for operation. The Bellavista mill has the same number of looms and is also driven by water power from the Tepic River.

The product of these mills consists principally of rough, unbleached cotton cloth known locally and throughout the West Coast as "Manta," and of white sheetings bleached. The output is sold locally in Nayarit and also sent to Guadalajara overland by pack mule to San Marcos station, pack-mule freight costing 5 pesos per "carga" of 350 pounds in two packs. This route of shipment is cheaper than routing by way of the port of San Blas and Manzanillo, and thence by rail to Guadalajara. The greater portion of the product goes to the latter place. The Bellavista mill has continued in operation.

A small mill has long been established at Villa Union, south of Mazatlan, on the railway. Eighty-two looms are in operation, the total number of operatives being about 50. The products are the same as those of the Nayarit mills. The annual volume of business amounts to about 210,000 pesos.

Though considerable in quantity, the cotton produced in the State of Nayarit is inferior in quality, for spinning, to that imported from the United States, on account of lack of care in picking and lack of modern ginning equipment. The mills import about 90 per cent of their raw cotton from the United States, and also about $25,000 worth of dyes annually.

Although American cloth can not compete with the rough material (for the use of the lower classes) turned out by these mills, the domestic supply is far from meeting the demand, and large quantities are imported from the United States via Nogales and Mazatlan, chiefly from houses located in San Francisco, Los Angeles, Nogales, and El Paso, which job factory products in the United States.

## SHOEMAKING.

The largest and best-equipped shoe factory is that of the Cruz Galvez Industrial School maintained by the State of Sonora and by popular subscription at Hermosillo. The shoe factory in connection with this industrial school constitutes the largest unit of the entire plant, having a capacity of 400 pairs of shoes per day. The equipment is modern and driven by electricity from the local lighting and power plant. Men's, women's, and children's shoes are made, as well as cloth slippers, etc. Domestic sole leather from local tanneries is used, but the upper material and all findings are purchased in the United States. A popular shoe made by this factory is one with imported top leather, native sole leather, rubber heels, laced, and a box-toe last. This type retails for about $7 United States currency per pair, while the imported American shoe of similar style and type sells for about $10 per pair at retail. At Guaymas and Hermosillo there are three or four small shoe shops producing all the way from a few pairs to 2 dozen pairs of shoes per day, only the largest of these shops being equipped with machinery of any kind, such as American sewing machines.

There are four large and two small shoe factories at Mazatlan, two or three small ones at Culiacan, and one at Acaponeta. The total annual output of these shops is about 150,000 pairs of all grades and styles of shoes.

A list of the larger Sinaloa factories follows:

1. *Marcelo Chavez, Sucs.* (*Mazatlan*).—Capital, 75,000 pesos; volume of business, 125,000 pesos; number of employees, about 25; 100 pairs per day.
2. *G. Galindo* (*Mazatlan*).—Capital, 25,000 pesos; volume of business, 50,000 pesos; number of employees, 15; 50 pairs per day.
3. *Teodoro Piczan* (*Culiacan*).—Capital, 60,000 pesos; volume of business, 200,000 pesos; number of employees, 11; tannery in connection.
4. *Fo On Tay y Cía.* (*Flor de Lis*) (*Mazatlan*).—Capital, 40,000 pesos; 100 pairs per day of cheaper-grade shoes; Chinese establishment.
5. *José Mario Diaz* (*Mazatlan*).—Established 1903; capital, 80,000 pesos; volume of business, 100,000 pesos; number of employees, 10.
6. *Feliciano Uriarte* (*Culiacan*).—Established, 1906; capital, 8,000 pesos; volume of business, 16,000 pesos; number of employees, 5.
7. *Alvarez y Cía.* (*Mazatlan*).—Capital, 50,000 pesos: 75 pairs per day.
8. *Victoria Romero* (*Mazatlan*).—Capital, 10,000 pesos; volume of business, 25,000 pesos; number of employees, 5; 25 pairs per day.

The combined capacity of the Mazatlan shoe factories is placed at 300 to 400 pairs of all kinds of shoes per day.

The product of the West Coast shoe factories is sold throughout the entire coast territory, in Lower California, and as far inland as the Jalisco territory. Large numbers of women's cloth-top slippers and shoes are sent inland in small lots and individual orders.

## SOAP MAKING.

Following is a list of the soap factories in Sinaloa and Nayarit.

1. *Compañia Jabonera Union y Concordia* (*Villa Union*).—Established 1910; capital, 50,000 pesos; 4,000 cases per month (1 case=34.5 kilos, or 75 pounds of soap).
2. *Manuel F. Lopez* (*Tepic*).—Established 1910; capital 15,000 pesos; volume of business, 60,000 pesos.
3. *A. O. Montes* (*Mazatlan*).—Capital, 50,000 pesos; volume of business, 100,000 pesos; 4,000 cases per month.
4. *Delius y Cia.* (*Germans*) (*Tepic; factory at La Palma*).—Capital of house, 750,000 pesos; investment in soap factory, 50,000 pesos; 4,500 cases per month.
5. *Aurelio H. Yuen* (*Chinese*) (*Mazatlan*).—Established 1912; capital, 8,000 pesos; volume of business, 120,000 pesos; 3,000 cases per month.

The soaps made are a cheap grade of blue colored laundry soap, cut in large and small bars, and various kinds of scented toilet soaps used by the poorer class of people.

The soap factories of the West Coast import from the United States large amounts of the chemicals used in soap making, the bulk of these shipments coming down to Mazatlan by water. The oil of the native coquito nut found in Nayarit, and imported copra, purchased in San Francisco, are the fats used principally. In northern Sonora, near the border, and as far south as Hermosillo, American laundry soap is most used.

All the soap factories also make candles, which are much used for religious purposes by the people of the country. Some native beeswax is used, but the principal material is imported stearin sold by the oil-refining companies.

In May, 1922, the Compañía Mercantil Manufacturera, S. A., a Mexican company with a capital of $20,000 United States currency, erected a new soap and toilet-preparation plant in Nogales, Sonora. The plant consists of a large brick building containing one 10,000-gallon storage tank and a 5,000-pound capacity cooking tank, as well as modern soap-making machinery.

The company is buying coconut oil in San Francisco and its tallow in Sonora and Arizona. The body of the soap will be composed of these two ingredients in about equal proportions. Laundry and toilet soaps are being made for the Mexican market.

The company was also preparing to make a line of toilet preparations consisting of face powders, creams, etc., the brand closely resembling that of a certain make sold in the United States. Mexico has a high protective tariff on all soaps (except laundry soap) and toilet preparations, and the demand for these products is rapidly increasing all over the country.

## BREWERIES.

Mazatlan has two breweries turning out a very good grade of barreled and bottled beer, which is sold throughout the West Coast territory.

The Cervecería del Pacífico was established in 1906 with a capital of 150,000 pesos, its annual sales amounting to more than 350,000 pesos. The capacity of the plant is 50,000 liters per month. Sixty men are employed. The plant has an ice-making unit.

The Cervecería de Mazatlan has been established more recently, with a capital of 400,000 pesos and an annual production of 250,000 barrels of beer per year.

During the period of the war the breweries of Mexico could not obtain their usual supply of barley malt and used broken rice grown in the Yaqui and Fuerte Valleys farther north along the coast. Since normal conditions have been resumed, the plants are now importing malt from the United States.

The Cervecería de Sonora, located at Hermosillo, has recently renewed operations after having been shut down during the revolutionary period. This plant has a capacity of about 60,000 barrels per year and a capital of 200,000 pesos.

In March, 1922, it was announced in Nogales that American brewers were to invest $100,000 United States currency in a new plant for beer making at Nogales, the machinery and equipment being brought from plants formerly operated in the United States by the same people, who had found nonalcoholic beer making unprofitable. The consumption of beer at Nogales amounts to about $250,000 a year, the supply now coming from Hermosillo, Mazatlan, and the larger plants in the interior of Mexico. The breweries of Orizaba, Monterey, and Chihuahua also ship beer to the West Coast. It was planned to supply the border towns of Mexicali and Tia Juana, where there is also a large consumption.

## DISTILLERIES.

In connection with all the sugar mills there are distilleries which produce alcohol and an increasing volume of liquors for domestic consumption, made with the sugar alcohol as a base and variously flavored and colored, much of this product being sold as whisky, cognac, etc.

There are also the "mescal" (or "tequila") distilleries of the two large agave plantations north of Culiacan, mentioned elsewhere in this report. In addition to the two large plantations mentioned, there are four or five smaller "mescal" plantations with distilleries supplying the local demand.

The Jarva Chemical & Distilling Co. has recently been established at Mazatlan by Americans, the products being whiskies, brandies, cordials, gin, and a line of flavoring extracts, syrups, and perfumes, put out for domestic consumption under the "Jarva" brand. The plant consists of a "Pots" still with a capacity of 500 gallons per day, three vats containing 5,000 gallons each, a 30-horsepower vertical boiler, and the motor drive equipment. There is a laboratory in connection with the plant. The manager states that the water supply of Mazatlan has been found 98 per cent pure and excellent for distilling purposes. The first products were put on the market in Mazatlan in October, 1922.

## MACHINE SHOPS AND WOODWORKING PLANTS.

The Fundición de Sinaloa, located at Mazatlan, operates a complete machine shop, small foundry, pattern shop, and woodworking shop, besides doing general work and manufacturing cast window, fence, and grill bar work. The capital is about 200,000 pesos and the annual turnover of the plant about 150,000 pesos.

The Compañía Industrial y Explotadora, S. A., of Guaymas, has the second largest machine shop and foundry plant on the West Coast and has, in connection with it, an ice plant, an electric generating plant, and a furniture-making plant.

At the present time the old electric plant is being dismantled and a new Diesel electric plant installed. The old plant consisted of a McIntosh-Seymore steam-driven generating outfit—2,300-volt, 133-cycle alternators—installed 25 years ago and used for lighting the city of Guaymas. The new Fairbanks-Morse, semi-Diesel, motor-driven plant has the usual modern current characteristics. There are three 150-brake-horsepower, semi-Diesel, fuel-oil motors driving 125-kilowatt, direct-connected alternating-current, 3-phase, 60-cycle, 2,300-volt generators. The current is transmitted at 2,300 volts, with 110 volts for lighting and 220 volts for power at consumers' terminals. The plant is also equipped with a steam-driven 75-kilowatt plant for the factory lighting and power supply.

A 50-brake-horsepower Fairbanks-Morse oil engine drives the ammonia compressor for the ice plant, which has a capacity of 20 tons of ice and a 40-ton refrigerating capacity. With the installation of the new fuel-oil motor drive this plant can turn out ice at a cost of $1.50 per ton and compete with the ice plant driven by a fuel-oil engine at Nogales for iceing tomato cars coming up from the West Coast for export to the United States.

The machine shop has six lathes, the largest being 34 inches by 18 feet. There are also four drill presses, a steam hammer, and other standard shop equipment. The foundry is a 1-ton cupola which can make a 1-ton-maximum casting. There are also three small brass furnaces.

The woodworking plant turns out office furniture, school and theater chairs, sash and door equipment, and there are plans for making, out of native hardwoods, a line of modern furniture, as well as phonographs, the mechanism for which will be imported from either Germany or the United States.

The equipment of this manufacturing plant also includes six modern machines for making wire nails, but this unit is now shut down on account of the lack of demand for this product on the West Coast at present.

An old match factory was purchased at Hermosillo and operated for a time at a good profit until the tax demands of the State government forced it to close down for a time. Since then the Government has reduced direct taxes to 20 per cent of the gross value of the output and increased the import duties on foreign-made matches, and this factory will start operations again in about six months' time. The capacity of the plant is 100 gross boxes per day. The matches made are wooden "safety" matches, packed in pasteboard boxes. Splits are imported from Germany and Sweden, the prices being lower than for a similar product from the United States, according to the statement of the manager.

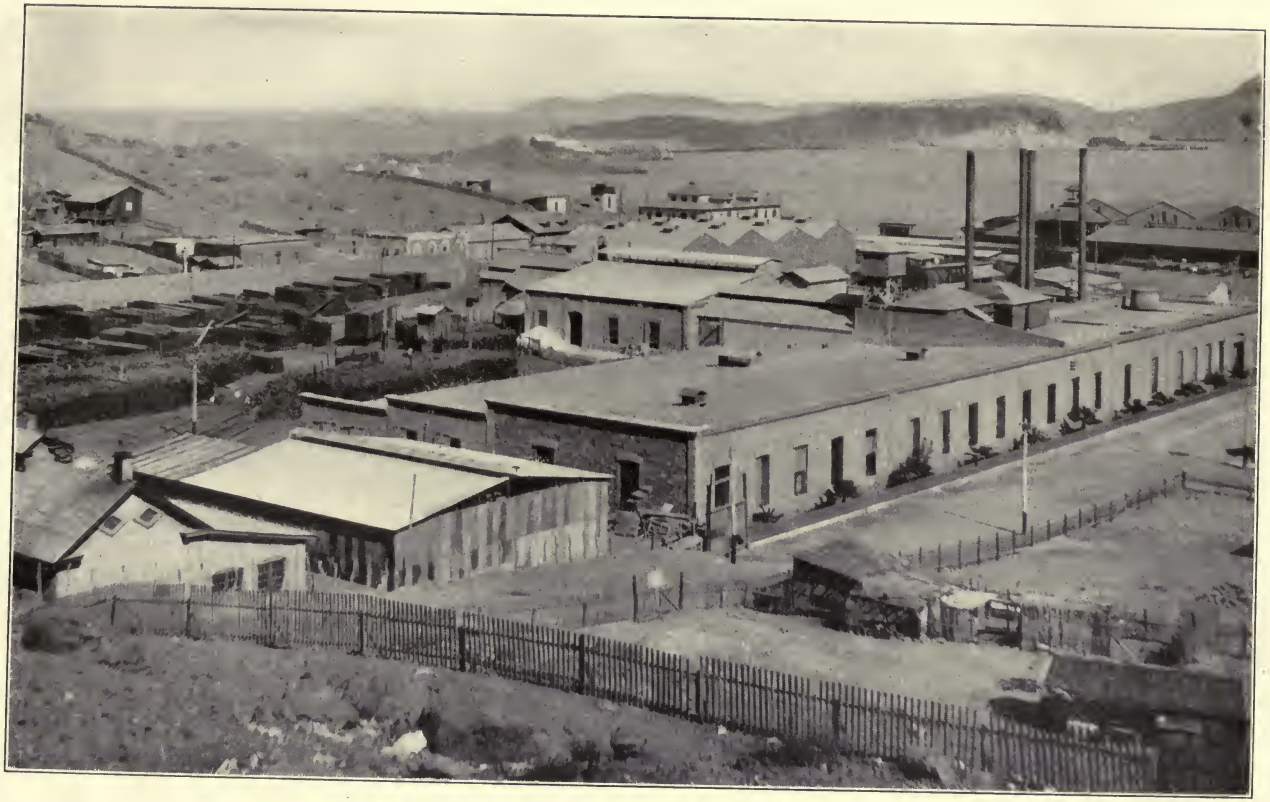

FIG. 15.—PLANT OF COMPAÑÍA INDUSTRIAL Y EXPLOTADORA DE MADERAS.

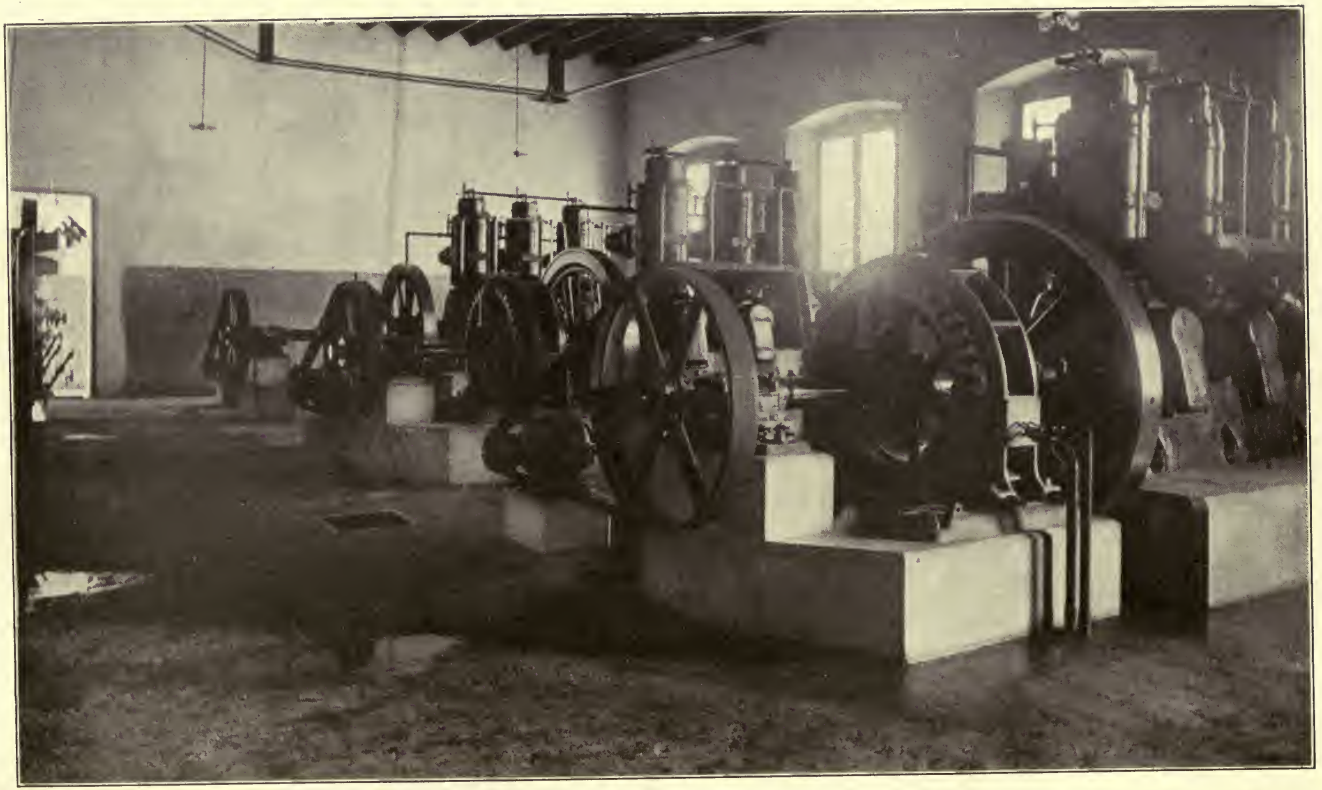

FIG. 16.—THREE UNITS OF SEMI-DIESEL ENGINES INSTALLED IN PLANT OF COMPAÑÍA INDUSTRIAL Y EXPLOTADORA DE MADERAS IN JANUARY, 1923.

The Southern Pacific Railroad of Mexico maintains complete railway shops at Empalme, near Guaymas. (See p. 53.)

### BROOMS, CARRIAGES, CARTS, AND FURNITURE.

The next largest manufacturing plant on the West Coast is that of Felton Hermanos (Americans), located for many years at Mazatlan. This plant makes brooms, furniture out of native hardwoods, carriages, carts, and wagons, and also some interior finishing work. The plant was established in 1880 and employs about 60 men as a rule. The annual volume of business is small. A match factory is operated in connection with this plant, supplying the local market and that of Tepic and Culiacan.

### CLOTHING.

There are several clothing factories on the West Coast, most of them being located at Mazatlan. A large new plant was erected at Hermosillo several years ago and equipped with modern electrically driven sewing machinery, the principal output being uniforms for Government troops in the State of Sonora and on the West Coast. The plant is now closed down.

The clothing shops of Mazatlan are as follows:

1. *Fernandez Hermanos, Sucs.*—Capital, 15,000 pesos; men's shirts, overalls, suits, etc., for local trade.
2. *P. C. Fuentes.*—Capital, 10,000 pesos; men's shirts, overalls, and tailor-made clothing; six employees.
3. *José Naves.*—Capital, 50,000 pesos; men's shirts, overalls, mattresses; also general dry-goods store.

Formerly very little ready-made clothing was imported on the West Coast, it being the custom of the country for the wealthy people to patronize local tailors or seamstresses for their clothes, or to outfit themselves when in California on their yearly trips, made usually during the hot season of the year. The poorer classes of the people bought the material in the local stores and clothing was made up by their women in the home, sewing machines being very common in this part of the country and found even in the most isolated mining camps and ranches of the far interior. Increasing quantities of men's ready-made suits are being imported from the United States, principally in light-weight materials such as "beach cloth," etc.

### DYE-EXTRACT FACTORY.

The first dye-extract factory to be established on the West Coast was that of the Tintas Mexicanas, S. A., owned by an American and started in 1917, the location being at La Cruz, north of Mazatlan on the Southern Pacific line. The capital invested is about 25,000 pesos, and the first product of brazil wood and fustic dye extracts was produced in April, 1922. The plant employs about 30 operatives. The first shipment totaled 41,635 pounds of dye extract, which went by water from Mazatlan to New York. The plant also turns out granulated dyewood for concentrated shipment.

## TOBACCO FACTORIES.

Cigars and cigarettes are made in all the larger towns of the West Coast from tobacco grown principally in Nayarit. There is one fairly large cigarette factory located at Hermosillo. Mazatlan has four, one of which has a capital of 2,000,000 pesos and an annual business of 1,500,000 pesos. About 200 people are employed in this industry alone in Mazatlan. Tepic and Compostela also have several large cigarette and cigar factories, and others are located at Santiago Ixquintla and Acaponeta. The cigars made do not compare in appearance or finish with those of the Cuban or Vera Cruz factories, the wrapper leaf not being as fine and smooth as is common in the cheapest grade of cigars sold in the United States. The great demand on the West Coast is for paper-wrapped cigarettes, the ends of the paper being turned in by hand and not gummed, while the tobacco is loose and granulated, not shredded.

The products of the Mazatlan and Nayarit factories are consumed in great volume all over the West Coast and in Lower California.

State and national taxes on the production of the tobacco products has been increased enormously during the past few years in Mexico—to such an extent that the cheapest grade of native cigarette, which formerly retailed for 0.03¼ peso now sells for 0.10 peso. American tobacco products do not enter this market, as the protective tariff is much too high.

## MATCH FACTORIES.

A list of West Coast match factories follows:

1. Compañía Industrial y Explotadora, S. A., Guaymas and Hermosillo.
2. Felton Hermanos, Mazatlan.
3. Juan R. Yzaliturri, Mazatlan.
4. Kondo Match Co., Culiacan; Japanese; small.

These match factories import normally about 6 tons of chlorate of potash annually, from the United States.

## CANDY FACTORIES.

Very little fine candy is imported, on account of climatic conditions and the high import duties on all kinds of confections. Some American bonbons and chocolates in box form are sold in the larger cities, principally Mazatlan, but the trade is small, as few people can afford the price and the product is little known to most persons. There is a very considerable household industry in the making of confectionery and small sweet cakes in all communities, the home-made goods being sold on the street by vendors from small wooden trays and stands.

A chocolate candy factory has recently been started in Tepic, Nayarit, where native cacao and chocolate can be obtained. High-grade chocolates and bonbons, as well as a variety of fancy colored candies, are being made and shipped on individual orders as far north as Culiacan by express and mail. The output of this small new factory compares very favorably with the best American product. Boxes, extracts, etc., are imported from the United States.

## TANNERIES.

There is a large demand for the rough domestic leather of the country for sandal soles, leather pack-saddle ("aparrejo") making, saddle making, shoe soles, etc. Small tanneries are found all over the country, even in the isolated interior, the best saddle leather (of a light cream color and very soft) coming from the town of Tameapa, north of Badiraguato, about 100 miles from Culiacan. The leather imported is used only for shoe uppers, belting, etc., and is of special stock. The native leather is crudely tanned, often having a white, hard center, spongy surface, and no finish. No machinery is used at the various tanneries, some of which are quite large. The principal reagent is "cascalote," which is found in the country in quantities more than sufficient for the domestic industry.

The San Geronimo tannery, located 3 miles from the port of Guaymas, employs 40 to 50 men and turns out an average of 1,000 to 1,200 sides of leather per week, all of which is shipped either to Mexico City or Guadalajara. During the revolution between 1916 and 1919, the plant was sacked and damaged by the Yaqui Indians, with a loss of 40,000 pesos. In August, 1921, this plant imported 2,700 American beef hides (64 tons) from San Francisco to supplement the local supply, on account of the depletion of the cattle in the State of Sonora as a result of revolutionary activities. The American hides were found to produce a much better grade of leather and to be cheaper in price than the native skins.

In Sinaloa and Nayarit there are 10 fairly good-sized tanneries producing an average of about 220 sides of native leather per day, the hides coming from the local slaughterhouses. The largest tannery in Mexico is that of Ruffoy Cía., located at La Paz, Lower California, where modern machinery and methods are employed, "split" leather being made, as well as a finished product for shoe work, saddlery, harness, etc.

This company is said to have a capital of 500,000 pesos. The plant is now being enlarged to give it a capacity of 300 hides per day, 100 per day being turned out at present. Green cattle hides are purchased locally and also up and down the West Coast and as far east as Chihuahua and other parts of Mexico. The product is shipped principally to Mexico City, the largest volume being native sole leather. During the war some leather was even shipped to the United States on account of the high prices being paid for this material at that time. All machinery used is of American manufacture. The principal tanning reagent used is the bark of the "palo blanco" tree found in this region.

The principal objection to the use of native Mexican leather for shoe soles is its bad odor, when wet or damp, and its half-crude condition. It is usually either too soft and spongy, or else left unevenly tanned in the center. Some tanneries, however, turn out a very creditable product which makes up nicely in saddle work, etc., though it does not have the elasticity and life of fine American or English leathers and more rapidly hardens and cracks after a few wettings when used for shoes, saddles, or harness, although this condition can be helped greatly by giving it plenty of foot oil and proper care.

## CONSIDERATIONS IN CONNECTION WITH MANUFACTURING.

The high import duties levied on all articles of manufacture that can be classed as articles of prime necessity, many of which could be manufactured locally, should have the effect of stimulating domestic industry, at least to the extent of supplying the local demand. However, the high taxes on capital investment in industrial facilities which would produce such a result, the general indifference of the laboring class, and the attitude of the officials toward capital and industry constitute the greatest drawback to Mexican development to-day. Until these conditions are changed, no great impetus is likely to be given to manufacturing industry, notwithstanding the natural and tariff advantages that exist. It should also be borne in mind, when considering this phase of development in Mexico, and also in all other Latin American countries, that the larger percentage of the population has not the same average purchasing power per capita as the people of the United States, and that therefore the market for products is much more limited for a given number of people. Given proper legal guaranties and helpful legislation, there undoubtedly exist many opportunities in Mexico, and also elsewhere in Latin America, for the establishment of factories making goods of prime necessity now being imported in large quantities, such as leather of the finer grades, glassware and chinaware, cloth, men's haberdashery, toilet articles and soaps, furniture (both metal and of wood), paper products, and innumerable other articles.

## COLD-STORAGE PLANTS.

Ice plants have been long established at Hermosillo, Guaymas, Culiacan, Mazatlan, and Tepic, but no cold-storage plants had ever been installed until in May, 1922, Americans put in a new plant in the Guaymas public market. The storage box is divided into three compartments, two for fish and one for meats and other products, and it has a capacity of 2½ tons. The fish compartment is held at a temperature of 16° to 20° F. The meat department holds 10 beeves and 8 hogs and is kept at 33° F. The room for cut meats has a temperature of 36° F. Refrigeration in the show cases is held at 45° F. Plans have been made for a larger meat and fish packing and storage plant if the present venture, in which a capital of $20,000 is invested, is successful.

The ice plants of both Culiacan and Tepic are very old, practically worthless, and badly in need of replacement, their production during the hot summer months not being nearly sufficient to supply the demand.

## ELECTRIC LIGHTING AND POWER PLANTS.

Most of the larger towns of the West Coast, not included in the list of the five largest cities, now have small, modern electric lighting plants, either municipally or privately owned. There is small demand for individual lighting sets, except in a few of the larger ranches and mining camps. Particulars concerning the principal West Coast plants are given below.

### HERMOSILLO, SONORA.

The Hermosillo plant is owned and operated by "La Hermosillense" flour mill company. The plant consists of two Corliss steam engines driving one 250-kilowatt and one 150-kilowatt alternating-current generators—2,300 volts, three phase, 60 cycles. Lighting voltage is 110 and power voltage 220. The plant has 1,200 consumers; the flour mill uses 60 kilowatts of the power output of the plant and power consumers about one-third of the total. Seventy-five per cent of the lighting equipment used in the city is made by one large American company. Wood is used for fuel in the power plant.

### GUAYMAS, SONORA.

For a description of the lighting and power plant at Guaymas—now being renewed—the reader is referred to page 200.

### SANTA ROSALIA, LOWER CALIFORNIA.

The Santa Rosalia plant is owned and operated by "El Boleo" Mining Co., controlled by the French Rothschild family, which owns the great copper mines located at this point. The plant consists of five units, steam driven, made by the Société d'Oerlikon, of Switzerland. The total capacity is 1,600 kilowatts, most of the current being used by the company's mines, smelters, and reduction plants. The current is alternating; frequency, 42; three phase; generator voltage, 5,000; secondary distribution, 220 and 380 volts; four wire.

### CULIACAN, SINALOA.

The Culiacan Electric Co.'s plant is owned by the Tariba family, and consists of two units, with steam engines driving, by belts, two alternating-current generators with a total capacity of 290 kilowatts. Transmission is three phase, 60 cycles, 2,300 volts, stepped down to 110 volts and 220 volts for lighting. No meters are used, there being a flat rate of 1 peso per month per 25-watt light.

### MAZATLAN, SINALOA.

The Mazatlan electric lighting and power plant is owned by the Empresa de Corriete Eléctrica, S. A. The generating plant consists of two 700-horsepower American-made steam engines and a direct-connected 165-horsepower producer gas motor of the Otto type, made in Italy, driving generators of American make, of a total capacity of 575 kilowatts, generating two phase, 60 cycle, voltage 1,100. Transmission is at 1,100 volts; lighting voltage 110 and power voltage 220. The number of customers served for lighting current was 1,215 in April, 1922, while power users numbered 18. Light and power charges, shown in United States currency, are as follows:

*Light rates.*—25-watt, $1.50 per month; 50-watt, $2 per month; 100-watt, $3 per month. By meter: First 50 kilowatts, $0.25; next 100 kilowatts, $0.225; next 100 kilowatts, $0.20; additional at $0.175.

*Power rates.*—1 to 1,000 kilowatts, $0.125; 2,000 kilowatts, $0.105; 3,000 kilowatts, $10; 4,000 kilowatts, $0.095; 5,000 kilowatts, $0.09; 6,000 kilowatts, $0.085; above 6,000 kilowatts, $0.08 per kilowatt.

### ROSARIO, SINALOA.

The Rosario plant is owned by the "Minas del Tajo," with offices in Mazatlan and at the mines. The plant consists of two German Duetz producer-gas motors, developing a total of 1,000 kilowatts; alternating current; transmission at 2,200 volts; terminals, 220 volts for light and 440 volts for power. The average load carried is 620 kilowatts. This plant supplies light for the town of Rosario, the current being sold through meters. The lighting rate is $1 United States currency per 25-watt light per month, and the power-current rate is $0.045 per kilowatt-hour. The principal use of current is for the mine plant of the "Minas del Tajo" company.

### TEPIC, NAYARIT.

The owners of the Tepic plant are D. G. Aguirre Sucs., the plant being located on the Tepic River at the falls, 3 kilometers from the city. Two American generators with a total capacity of 350 kilowatts are driven by water wheels. The current is alternating, three phase, 60 cycle, generator voltage 6,000; distribution at 2,300 volts; light 110 volts and power 220 volts. The capacity of the largest single-phase motor permitted is 35 horsepower. The capacity of the largest motor with short-circuited rotor is 15 horsepower. Current is sold through meters. The rate for lighting is $0.75 United States currency per lamp of 40 watts, while for power it is $7.50 per month per horsepower.

### ENSENADA, LOWER CALIFORNIA.

The plant at Ensenada is municipally owned and has one 50-kilowatt and one 12-kilowatt generator. The prime movers are petroleum engines. The supply is three-wire, 110/220-volt direct current. The plant operates from 5 to 11 p. m. The 12-kilowatt generator is used to supply the theater in the town. The rate is $1 United States currency per outlet per month.

### EMPALME, SONORA.

The Southern Pacific of Mexico Railroad Co. has, at Empalme, a plant with two tandem compound steam engines operating 200-kilowatt generators. The supply is direct current, three wire, 110/220 volts. The rate is 7 cents per kilowatt-hour for both light and power. The connected load of this plant exclusive of the railroad shop is only 19 kilowatts.

### CANANEA, SONORA.

The Cananea Consolidated Copper Co. has a plant with a total capacity of 9,100 kilowatts. Current is generated at 2,300 volts, alternating current, three phase, 60 cycles, and distributed at 110, 220, and 440 volts.

## LIVE STOCK.

### CATTLE RAISING.

For many years cattle had been one of the principal and stable sources of wealth of all the West Coast territory until the revolutions greatly depleted the herds. At present the supply of beef cattle is ample for local needs, and Sonora has an excess of beef cattle for export to other parts of Mexico, being about the only region in the Republic where this condition obtains to-day.

The States of Sonora and Chihuahua have great expanses of open-range country in which semiarid desert conditions prevail and which have long been famous cattle-producing sections of Mexico. Farther south along the West Coast the coastal plain becomes very narrow, brush and timber increase with the rainfall, and there is no open range as the term is applied in the Western States of the United States. In Sinaloa and Nayarit the cattle run in the brush and foothill mesas during the rainy season and are collected and held in the cornfields after the corn harvest in the fall when the brush is dry. The northern half of Sonora has long been recognized as a good cattle country and the greater portion of the land has been devoted to cattle for generations, large numbers being exported to the American markets annually prior to the revolutions. Americans own and operate some of the largest and best cattle ranges in this State, but they, in common with the Mexican cattle raisers at present, are suffering from the effect of low prices for cattle, combined with the difficulties of securing banking accommodations for the purpose of holding their herds on the range until market conditions improve. The cattle industry of the United States faces the same conditions, but in Mexico the difficulty of securing money is accentuated. Cattlemen are forced to sacrifice their market stock at ruinous prices. During 1922 cattlemen with range and capital were buying yearlings at $5 United States currency per head, paying slightly more for selected stock near the border or rail transportation. Offers were being received in Nogales in July and August for the sale of 2-year-olds at $7 per head, delivery to be made on the Mexican side of the line. Beef cattle 4 and 5 years old were selling for $20 to $22 per head, United States currency. Northern Sonora was shipping cattle for slaughter purposes to Hermosillo and Guaymas. The northern range had plenty of rain in the summer of 1922, and the range conditions for that year were very good.

When the above range prices obtained, the American import duty on cattle from Mexico was 30 per cent ad valorem, amounting to an average of $4 on 2-year-olds and about $6 per head on 3-year-olds. Taking into consideration the American import duty, the freight to the border, and the dipping, it was found that the prices being paid for the pick of the Mexican herds in July, 1922, netted the owners about $8.25 per head, United States currency, for 3 and 4 year old stock. Invoice values of cattle being imported from Sonora to the United States in 1922 averaged $12.13 each for 2-year-olds and $15.50

per head for 3-year-olds, although some sales were made at $17 per head for 3-year-olds, and heavy stock went as high as $25 each. (See reference to tariff act of 1922 on p. 210.)

Milk cows are in demand and are being imported from the United States, Holsteins being preferred. Breeders were importing little or no blooded stock for the range breeding in 1922.

The cattle industry of Sonora is no longer in the hands of a few powerful cattle magnates, but is distributed, in general, among small stockmen. The most important market for Sonora cattle for the past year, or longer, has been in Mexico City, which has been taking an average of 700 head per day of imported cattle. Beef cattle have also been recently imported by water via Vera Cruz from Colombia, Venezuela, and Guatemala to supply this demand.

The cattle from Sonora destined for the Mexico City market are shipped by rail, in bond, through the United States. They reenter Mexico at Laredo, Texas, and are sent south from there as domestic stock, which receives the benefit of a differential freight rate—about one-third as much per carload as the rail rate on American stock, which also has to pay a heavy bridge toll rate and is subject to Mexican quarantine regulations affecting live stock. All these disadvantages greatly increase the expense to shippers of American cattle, of which there was a large surplus held over in the winter of 1921-22 on the ranges in southwestern Texas on account of the prevailing market conditions and low prices for beef cattle in the United States. Because of the high American import duty on beef cattle, Mexico City has been taking the greater bulk of Sonora's surplus cattle production during 1921-22. During 1921 more than 100,000 head of cattle for slaughter purposes were sent into Mexico City from Texas and Sonora, the larger proportion being American cattle.

### HOGS, SHEEP, AND GOATS.

The production of hogs is sufficient for the domestic demand throughout the West Coast. Hogs are sold by the head and not by weight. A fat animal weighing 100 kilos or over (approximately 220 pounds) sells for $15 to $20, United States currency.

Commercially speaking, there are no sheep or goats anywhere in the West Coast territory. Sheep do not do well in the hot climate and brush of Sinaloa or Nayarit.

### IMPORTATION OF MEXICAN CATTLE TO UNITED STATES IMPRACTICABLE.

The new American tariff act of 1922 imposes an import duty of $0.01½ per pound on beef cattle up to 1,050 pounds in weight, bringing the import duty on range cattle from Sonora to from $9 to $11 per head on 3-year-old stock. This amounts to practically 70 per cent of the value of the animal at present-day prices in the United States for this class of beef material. This increase in the American import duty on cattle from Sonora renders impracticable the importation of Mexican stock into the United States. The Mexican import rates on American and South American cattle have recently been increased by the Mexican Government, and this provision should greatly assist native breeders.

The cattle ranges in Nayarit were practically denuded of stock during the years of revolution, although enough cattle remain for

the local supply of beef and for draft-oxen purposes. Sinaloa has sufficient cattle left—held in very small herds of a few hundred each, or less. Prices at present are so low and the local slaughter demand so small throughout the State that little attention is being given to this branch of industry.

There are no reliable figures covering the number of head of live stock now on the West Coast of Mexico.

### EXPORTS OF BEEF CATTLE.

During 1920 exports of beef cattle from Sonora to the United States through the entry ports of Nogales, Douglas, and Naco, Ariz., totaled 47,023 head, valued at $1,559,173, United States currency. In 1921 the number of head was only 14,171 and the declared valuation $369,515. During the first six months of 1922 exports of cattle from Sonora totaled 12,240 head, valued at $178,319. The decrease in exports of beef cattle to the United States in 1921 and 1922, as compared with 1920, was due to the drop in prices coincident with the slump in prices for all commodities in the fall of 1920. Prerevolutionary exports of cattle from Sonora to the United States averaged about 100,000 head per year.

### FUTURE OF THE INDUSTRY.

The northern half of the State of Sonora is a natural "open-range" cattle country throughout which the production of beef cattle can be greatly increased under normal political and market conditions. The future of the industry in this section depends upon several factors, among which are the recovery of the market, stable political condiditions in Mexico, and guaranty of land titles, which are now affected by the ever-present danger of confiscation under the agrarian law of Mexico—several American ranches in Sonora having been recently taken over for partition and allotment to the "pueblos."

### CATTLE-RANGE CONDITIONS IN NORTHERN SONORA.

Grass is plentiful on the high mesa lands of northern Sonora except in years of unusual drought. Browse remains green all the year round. There is little surface water, but sufficient water for stock can be easily obtained almost anywhere by means of shallow wells. The average altitude of the range country is 4,000 feet above sea level, and there is little or no snow, cattle wintering on the range in good condition when there is sufficient feed. The cattle are not fed in winter. The top soil contains little alkali. The region is remarkably free from disease, on account of the elevation and dry climate.

Average estimates place the grazing area for one head of range stock at 15 acres.

Sheep are few, and no estimates on grazing them can be obtained.

The State of Sonora leases Government and State lands for livestock grazing on the following terms and conditions:

For a temporary grazing permit, valid for an indefinite period, a charge is made of 1 peso per head shown on the importer's manifest, and thereafter an annual tax of 12 pesos per 1,000 pesos of the value

of the cattle held on the range leased, this valuation being arbitrarily fixed at 15 pesos per head. This tax is payable quarterly in advance.

The regular land tax applying to residents varies with the location of the land. There are three groups, depending upon the general situation and location, and each group is again divided into four classes: (1) Near railroad and with water; (2) with water and improved; (3) unimproved but capable of improvement; (4) barren lands. The taxation rates per annum are as follows, per hectare (1 hectare = 2.47 acres):

| Classes. | First group. | Second group. | Third group. |
|---|---|---|---|
| | *Pesos.* | *Pesos.* | *Pesos.* |
| Class 1 | 2.00 | 1.50 | 1.00 |
| Class 2 | .75 | .50 | .25 |
| Class 3 | 1.00 | .75 | .50 |
| Class 4 | .04 | .03 | .02 |

The lands near the larger towns are placed in the first group.

The tax rates per annum on cattle are:

| Value. | Tax per 1,000 pesos valuation. | Value. | Tax per 1,000 pesos valuation |
|---|---|---|---|
| | *Pesos.* | | *Pesos.* |
| Up to 5,000 pesos | 8 | Up to 20,000 pesos | 11 |
| Up to 10,000 pesos | 9 | Above 20,000 pesos | 12 |
| Up to 15,000 pesos | 10 | | |

There is no Mexican import duty on cattle brought into the country to stock ranges, nor is any export duty imposed.

## AMERICAN IMPORT DUTIES ON LIVE STOCK.

According to paragraph 701 of the United States tariff act of 1922, the duty on cattle weighing less than 1,050 pounds each is $0.01½ United States currency per pound live weight; and on those weighing 1,050 pounds each, or more, $0.02 per pound. According to paragraph 702, sheep and goats pay a duty of $2 United States currency per head. Paragraph 714 provides an import duty of $50 per head on horses and mules valued at not more than $150 United States currency per head; while on those valued at more than $150 per head the import duty into the United States is 20 per cent ad valorem. Paragraph 1506 provides that live stock straying across the boundary into Mexico, or driven across by their owners for pasturage temporarily are, together with their offspring, free of duty if brought back into the United States within eight months.[19a]

[19a] By joint resolution of March 3, 1923, the above period has been extended to one year, effective March 4, 1923, and constituting a special privilege only for one year.

## PETROLEUM.

### PROSPECTING FOR OIL.

The entire peninsula of Lower California and the West Coast territory have been variously explored for indications of petroleum by parties of geologists from time to time without the drilling of a single exploration well thus far, although such drilling is predicted for the district lying to the north and east of Guaymas in the near future. The territory has been covered from time to time by Government concessions, many of which are still in force and being offered to the various large oil companies in the United States and Europe.

In 1922 one of the Federal Government concessions covering the entire coast district of the State of Sonora was explored by an American oil company and the bulk of the territory turned back to the concessionnaire, with the exception of certain areas in the Altar district in which it was planned to drill test wells in the near future.

Indications of oil have been recently found near Elgin, a short distance north of the Mexico-Arizona line, near Nogales. Local capital (the Nogales Oil & Gas Co.) is now drilling a test well to determine the value of the territory for oil. In May, 1922, another report indicated that Texas oil interests were preparing to drill another test well in Sonora across the line from Agua Prieta, application for the necessary drilling permit having been made to the governor of Sonora.

The Sonora State government, in the hope of realizing large revenues from petroleum production, has variously encouraged prospecting for oil in that State. In December, 1921, a Mexican engineer and geologist reported the discovery of surface indications of petroleum in the Altar district, and it was rumored that one of the large American oil companies had purchased part of a tract of 1,500,000 acres of land in the northwestern part of Sonora.

Sinaloa and Nayarit, particularly the latter State, have been prospected for indications of petroleum, usually by American engineers following rumors of seepages, etc., brought in by natives. To date these reports have resulted in nothing definite in the way of surface indications of petroleum bodies, although geologists state that the structure of a basin which lies about 50 miles north of Culiacan might lead to the discovery of oil. No oil wells have been drilled in either State, so far. Prospecting for oil along the West Coast has included the various islands of the Gulf of California, including Carmen Island north of Guaymas, which was the scene of an expedition early in 1920.

In 1919 the Department of Commerce and Industry of the Mexican Government sent to the West Coast and to Lower California a mineral-survey expedition which paid particular attention to indications of petroleum on the islands of the gulf.

Oil shale is said to have been found in drilling wells for water supply at Cananea several years ago.

## SALES METHODS FOR PETROLEUM PRODUCTS.

The northern part of the State of Sonora is really part of the Arizona trade territory for the distribution of refined petroleum products, although the Mexican Eagle Oil Co. (Compañía de Petroleo "El Aguila," British) maintains supply depots of products, including gasoline, kerosene, and lubricants, at all the larger cities and towns—shipping from its refineries on the Gulf of Mexico by water via the Panama Canal to West Coast ports—and sends out salesmen to cover all the commercial districts of the West Coast, the main office and depot being located at Mazatlan. In northern Sonora refined products are supplied chiefly by American oil companies from the United States, but the Mexican refineries can supply bulk fuel oil to the mines cheaper than the American companies can. Prices are the same as for the Arizona border cities, plus freight charges, import duties, and handling charges, on refined products.

Refined products, principally kerosene, are handled by small dealers in the interior who purchase their supplies from the depots in the larger cities.

## MEXICAN IMPORT DUTIES.

Gasoline is free of import duty, but kerosene pays 0.10 peso per kilo legal weight, or approximately $0.15 United States currency per gallon, a gallon weighing about 3 kilos. Crude and fuel oils pay no import duty. Lubricants pay 0.07 peso per kilo, or $0.03½ United States currency per gallon.

## IMPORT FIGURES.

Imports of petroleum products from the United States, through the Nogales district (including Naco, Douglas, and Agua Prieta), during the calendar year 1921 were as follows:

| Classification. | Gallons. | Value, in dollars. |
|---|---|---|
| Crude oil | 734,862 | 10,644 |
| Fuel and gas oil | 527,101 | 32,156 |
| Illuminating oil | 25,147 | 6,950 |
| Gasoline | 471,318 | 112,041 |
| Other naphthas | 12,787 | 2,162 |
| Total | 1,771,215 | 163,953 |

Of the above total of crude oil, 612,181 gallons, valued at $6,599, were from Mexican fields.

The petroleum products imported through the port of Mazatlan and distributed throughout the States of Sinaloa and Nayarit during the calendar year 1921 amounted to $432,795 United States currency, although the larger portion of the gasoline and kerosene consumed was from refineries on the east coast of Mexico, produced principally by the "El Aguila" and Pierce oil companies. The consumption of gasoline is steadily growing with the increasing numbers of automobiles in use throughout the West Coast.

## USE OF FUEL OIL.

In December, 1922, the Southern Pacific Railroad of Mexico began construction of two steel oil tanks at Ardilla Point, Guaymas—the tanks to have a capacity of 150,000 barrels—for the purpose of supplying the locomotives of this railway from Guaymas to Tepic, Nayarit. This step became necessary on account of the increasing cost of coal and wood for fuel. The tanks will be located on the top of Ardilla Island, the oil being delivered by gravity into the tank supply cars of the railway. The fuel oil will be brought by tank steamers from Tampico, via the Panama Canal.

The Compañía Naviera de los Estados de Mexico (Mexican States Steamship Line) has recently purchased the oil barge *Simla*, having a capacity of 23,000 barrels, from the Union Oil Co., of California, to be used as a fuel-oil storage barge at Manzanillo. Fuel oil will be furnished to vessels of other lines in an emergency. This provision of fuel oil at Manzanillo on the West Coast follows the discontinuance of the fuel-oil supply service of the Eagle Oil Co. (Compañía de Petroleo "El Aguila") at Salina Cruz. Vessels touching at Salina Cruz for fuel oil must now wait about one week, until the supply can be shipped in tank cars from the Gulf of Mexico side of the isthmus over the Tehuantepec Railway, the cost at Salina Cruz being $4.25 per barrel, against $2.50 at Manzanillo.

## MINING.

### OUTLINE OF DEVELOPMENT.

In early colonial times the mining country of the West Coast of Mexico stretched from the Gila River in Arizona, across the deserts of Sonora, down the Sierra Madre Range to Jalisco. Arispe, the old capital of the Royal Provinces of Sonora and Sinaloa in the time of Philip III, of Spain, was the northern center of the industry, and the region produced one-fifth of the riches that found their way to Spain. Mining was the principal industry everywhere for two centuries. To-day the ruins of ancient towns and mission churches—many of them marked only by the remains of old walls—are found along the river valleys and in the hills where the old camps existed. The Indians were good surface miners, and the conquerors utilized their labors to the fullest extent. With slavery and peonage, even low-grade properties, which can not be worked to-day with modern mechanical and chemical methods, were made to pay a profit. From 1810 to 1821 revolt wasted the land, and many are the tales of hidden mines of fabulous richness which were closed and hidden by their Spanish owners in their retreat from the country.

Communication was by pack mule, and even the Indians were used in the mountains as burden carriers. The old routes, known as "caminos reales," were dotted with military stations, or blockhouses, where garrisons protected the bullion trains from the Indians and bandits. During the troubled time of the first Governments of the Republic of Mexico the territory was practically abandoned to its own devices by the central Government, and the depredations of Indians and bad characters hurt the mining industry. In 1825 came the great Apache uprising. Thousands were killed in Arizona and Sonora, and hundreds of productive mines were abandoned. In 1853 came the Gadsden Purchase, which gave part of the region to Arizona. After the Civil War, in the seventies, the military authorities of the United States were able to cooperate with the forces of General Diaz against the Indians, until in 1884, the last of the predatory bands were either killed or captured. For the first time in 60 years peace returned to the region and mining again became active with an influx of American miners and capital into Sonora. During all these years of devastation and danger a few rich mines had managed to continue operations. Many records of this time read like romances of the Spanish Main. There are tales of lost mines, treasure, old maps, deathbed secrets of mine and treasure locations, Indian raids, expeditions, political intrigues and plots, military movements, revolutions, death of entire parties from thirst and hunger on the desert—a long history in which many Americans of the pioneer stock took an active part.

There are mines with a record of a production of $30,000,000 in silver and gold. Some mines have been worked almost continuously for 300 years. In Guadalupe y Calvo, in southern Chihuahua, the British carried machinery in from Vera Cruz and Tampico, in oxcarts overland, and then on mules and men's backs into the high mountains crossing the backbone of the range to this rich property—to reach

which now involves six days' hard mule-back travel from the end of the Parral & Durango Railway out of Parral, from the eastern side, and about the same by trail, from the railway on the West Coast. This company imported even pianos by the same route, and the managers and superintendents rode through the mountains in chairs carried by peons and Indians. In 1905 the stamps of the mill on the Batopilas property of Governor Shepard, located in Chihuahua near the Sinaloa line, frequently hung up on the cams on account of the silver and gold in the ore collecting under the stamp shoe in such quantities as to necessitate removal by means of a cold chisel. Fortunes have been taken from old gold mine dumps by cyanide. Everywhere in the mountains there are tales of rich old mines called "antiguas," and the prospector and engineer often finds veins in which are seen the old drill holes made with a round iron bar 3 to 4 inches in diameter, shod with steel, and the hole sprung with quicklime burned near by and packed to the workings on mules or burros. In Badiraguato, Sinaloa, the mining agent, living in an old colonial house, found a hidden treasure in the walls left there by the colonial Spaniards when they were driven from the country by the Indians and "mestizos."

In 20 years Sonora came to the front as a mining country; the region took on new life, mining was resumed in all parts of the West Coast, old mines were opened and wonderful new discoveries were made. Machinery was brought in, and great, modern mining camps were established, having their own railways to connect with transcontinental lines in the United States. Arizona and Sonora reached the front rank as copper producers, the great mines at Cananea, Bisbee, and Nacozari producing a total of 118,057,000 pounds in 1903. The production of gold and silver also reached large proportions and increased annually. The Minas Prietas mines alone, about 200 miles south of the border at Nogales, produced an annual value of $3,000,000.

The western watershed of the Sierra Madres in Chihuahua, before the construction of the Southern Pacific down the West Coast in 1908 and 1909, was reached from the Mexican Central Railway from El Paso, thence to Parral, and then by the Parral and Durango logging road into the mountains to the west, whence mule transport was used across the main range to the western side, to Guadalupe y Calvo, Morelos, Barborigame, El Trigo, etc. Miners and engineers also traveled down the railways to Guaymas and took steamer to Topolobampo, Altata, and Mazatlan for the eastern Sinaloa and Nayarit regions, all reached from the coast by mule travel into the interior. It is safe to say that there is hardly an old trail, or old mine, or district into which some American prospector or engineer has not penetrated in all of the vast territory from the American line down to Jalisco. The natives are excellent surface prospectors and know the ore signs well, and the country has been well "surface-prospected" for many years ever since the Spaniards induced the natives to seek for minerals for them in colonial days.

To describe the various mining districts and mines would tax the capacity of a library. Gold, silver, copper, lead, zinc, tungsten, molybdenum, graphite, coal, manganese, gypsum, and diatomaceous earths—all are in the list of production. There are districts of copper and zinc formations, others of free-milling gold, others (and the most numerous) of silver and gold ores, with the first-named metal usually

predominating in the ore content. Free-milling gold is found in black porphyry in one of the largest gold mines of the West Coast. One mine in Sinaloa carries a high value in bismuth oxide, which occurs with copper, silver, and gold combinations. Iron is known to exist in large quantities in Lower California and in Sinaloa. The Sahuaripa district in southern Sonora has been described as one of the most heavily and richly mineralized regions in the world by a great American geologist and mining engineer.

The success of the great camps, the new discoveries, the old, lost mines, and all the rest of the activity of mining in Sonora and the rest of the West Coast brought in its wake the usual number of irresponsible promoters. Failures have been many—frequently due to ill-advised selection of properties or to inexpert management. Often good mines have been abandoned after having been involved in promotion schemes. Many millions of dollars of American money have been invested, in large and small amounts, during the last 30 years in mines on the West Coast.

The industry reached its maximum productivity and progress in 1910 just before the Madero revolution in Mexico. There followed 11 years of warfare, with periods of comparative peace when a few of the best properties would be reopened and worked for a few months, only to be shut down again in consequence of some new disturbance. In some cases there was looting and destruction of entire mining camps equipped with costly machinery and plants for ore reduction. Lastly, there came the market depression in copper, zinc, and silver. Many of the old producing properties, known to be rich, have been shut down for years. Certain other mines, with a long record of production, were able to continue to operate after a fashion.

The possibilities of mining throughout the West Coast region may be said to be very well known to American mining people. Colorado, California, and Arizona mining capitalists have long been interested in this field for development and are closely in touch with the situation in many districts. For the past two years mining engineers have been again scouting the territory, seeking new properties and, principally, for the purpose of picking up good properties, with a history of production, that have been abandoned during the years of warfare in Mexico. This preliminary work was especially active in Nayarit in the fall of 1922, when more than a dozen American engineers representing the large mining interests of California, Arizona, and Sonora were engaged in looking over the State for the purpose above indicated. The great copper mines of Cananea and Nacozari, in eastern Sonora south of Douglas, Ariz., have recently resumed operations after having been shut down for a year and a half, and the rehabilitation of the industry and its future development depends upon the policy of the present Government in Mexico.

## PRINCIPAL MINING CAMPS AND DISTRICTS IN SONORA.

(NOTE.—The following description of the principal mining camps, mines, districts, and formations is taken from "An account of the great mineral region south of the Gila River and east from the Gulf of California to the Sierra Madres," by Allen T. Bird, editor of the Oasis, Nogales, Ariz., and published under the auspices of the Arizona and Sonora Chamber of Mines in 1904, appearing in the form of a booklet entitled "The Land of Nayarit." Additions and corrections in this have been

made by Trade Commissioner P. L. Bell, principally from his personal knowledge of the mines and mineral regions of western Chihuahua, Sinaloa, and Nayarit. Through the section on "Altar district," on page 231, these discussions refer to properties that were operating in 1904. Properties developed since that year are described in subsequent sections.

### CANANEA COPPER MINES.

The Cananea Consolidated Copper Co. (Greene Consolidated Copper Co. in the United States) has developed and established one of the greatest copper mining camps in the world. As long ago as 1904 the holdings of this company, in mine lands, covered 4,214 "pertenencias" (1 pertenencia = 1 hectare = 2.47 acres), or 10,408 acres, and various other properties have been taken up and developed since that time, both in the same region and elsewhere in Sonora. The ores handled by the plants are of great variety, including great masses of oxides, carbonates, and sulphides, with frequent deposits of native copper, occurring throughout a distance of 7½ miles along the main tract of the company, which lies along the east side of the southern half of the main range of the Cananea Mountains, 75 miles southeast from Douglas, Ariz.

The mineral holdings of the Cananea Consolidated Copper Co. are divided into five zones—the Veta Grande, Cobre Grande, Esperanza, Capote, and Puertocitas. Work in these ore bodies constantly extends their limits, and extensive development work exposes great reserves of valuable ores.

The plant at Cananea is one of the most extensive and complete on this continent. The buildings have steel frames, covered by iron sides and roofs. The power plant has three engines, direct-connected to one 100-kilowatt generator and two 200-kilowatt generators. This plant generates light and power at 250-volt current for the plant and also for the two towns on the property—Cananea and Ronquillo.

A new concentrating mill recently put into operation has a capacity of 2,400 tons. By its use in concentration of the siliceous ores, and smelting of the concentrates with other nonsiliceous ores, the ore consumption is raised to about 3,000 tons daily and the output of blister copper more than doubled, with a possible annual output of 100,000,000 pounds of refined copper.

The mines and plants are connected by 11 miles of standard-gauge railway well equipped to handle the tonnage movement of the company.

Mining and smelting operations were suspended during one year and a half up to August 15, 1922, when these properties were reopened with a force of 3,600 men after favorable arrangements had been made with the government of Sonora regarding the interpretation of certain clauses of the new labor laws of Mexico included in the Constitution of 1917. The new oil-flotation plant was completed at a cost of nearly $1,000,000 and was expected to effect a saving of 10 to 15 per cent of the ore values. The capitalization of the company is $8,640,000 United States currency.

This single company ordinarily works a force of 6,000 to 9,000 men and keeps on hand stocks of general merchandise running up to $250,000 in its stores for the workmen. With the mines working "full blast," the town of Cananea had a population of about 20,000.

The Indiana-Sonora Mining Co., a subsidiary of the Copper Queen in Arizona, also has extensive holdings at Cananea from which ore is shipped to smelter at Douglas.

The Demócrata Mining Co. has properties in a central location, surrounded by those of the great Cananea Company. Its ground has been well developed, and the company operates a 250-ton reduction plant.

In the Cananea Mountains there are several undeveloped and partly developed valuable copper properties which need only capital and scientific management to make them producers. This region is but one field in the great copper belt reaching from Globe, Clifton, and Morenci, north of the Gila River, through to the Mayo River in Sonora, including the three camps already named, together with Bisbee, Cananea, Nacozari, and Transvaal, in the Moctezuma district; Santo Niño (Yaqui Copper Co.), Tonichi and Chipiona (Cienegita Copper Co.), in the Sahuaripa district; Bayoyeca and Piedras Verdes, in the Alamos district; and others farther south and less known.

### MAGDALENA DISTRICT.

The Magdalena region in Sonora was one of the richest mining districts of the Republic and the scene of many of the old colonial "bonanzas." In 1739 a discovery was made at what is now the "Planchas de Plata" mine, which attracted attention not only in the New World but in Europe as well. Masses of silver weighing as much as 525 pounds were found.

Other old producing mines include the Cocospera, Higuera, and Cerro Prieto, since then the scene of great activity in more modern times.

The Planchas de Plata mine is located only about 20 miles southwest of Nogales, Ariz., and is now being operated by P. Sandoval & Co., of Nogales. In February, 1922, the company had from 25 to 30 men employed and was operating the old 10-stamp mill with which this property is equipped. Monthly net profits were said to be about $1,500. Large bodies of low-grade ore have been blocked out, and it is reported that 500 tons a day can be supplied to a reduction plant. The first mill was erected on this property in 1878, and since then the mine has had a varied history.

### GEOLOGICAL CHARACTERISTICS OF LAS PLANCHAS DISTRICT.

The geological characteristics of the Las Planchas de Plata region are striking. To the eastward, at a distance of 8 to 10 miles, an immense trachyte dyke, running north and south for many miles and many hundred feet in width, has been thrust up through a series of limestone beds superimposed upon a porphyry field, pushing back both formations, folding and crumpling back the country rocks for miles around. In the axis of the folds, the crushing and crumpling of the rocks on the lines of contact, aided by an upthrust from below, broke and ground the porphyry into a fragmentary condition, leaving in many places great air vesicles and even chambers. Then came a great flow of superheated waters, strongly impregnated with salts of silver, depositing bromides and chlorides upon the cleavage planes of the broken rock and filling the chambers and vesicles with the native metal. Released from their beds by erosion, and rolling into

the stream beds, these great masses of pure silver constituted the "bonanzas" of the early colonial miners and explorers. The silver-bearing rocks are plainly porphyry, and where they have been greatly crushed and broken the values run high; where they are in larger pieces, values are lower. The ores that have been milled run from 100 ounces up to 2,000 ounces of silver per ton. The great masses of low-grade ore left in the mine run from 30 to 60 ounces of silver per ton.

The holdings included in the properties of Sandoval & Co. (Big Mountain Mining Co.) comprise about 320 acres. In this same vicinity are the Mejia mine owned in Guaymas and the Corrusca mine owned in Nogales. The latter property is being developed under bond.

About 6 miles north of Las Planchas de Plata are the Promontorio mines, owned and operated by the Promontorio Consolidated Mining Co. During many years these mines were constant shippers of high-grade ores. A small concentrating plant treated the low-grade ores, and the concentrates were shipped to smelters in the United States. This property is close to the railway.

About 25 miles southeast of Planchas de Plata, 12 miles to the east of the Southern Pacific Railway, at Quijano Station, 30 miles south of Nogales, is the camp of the Hays Mining, Milling & Lumber Co., of Washington, D. C. This corporation owns 50,000 acres of timber lands, underneath which run large and well-defined ledges of copper, carrying gold and silver values, and a large gold-bearing ledge 12 feet in width.

### COCOSPERA REGION.

On the east side of the Pineta Mountains is the valley of the Cocospera River, where are found the ruins of an old mission church and large slag dumps, indicating extensive smelting operations. In the Pineta Mountains and in the Cerro Azul are many "antigua" mines, whence came the ores reduced at the crude smelters of the colonial miners. In one of these "antigua" mines the Sierra Azul Mining Co. has developed a fine body of high-grade wolframite, rich in gold values, the ore concentrating easily.

West of the railway in this region are the Guacomea Mountains, in which there have been mining operations to some extent. The Guacomea Mining Co. operated a 20-stamp mill several years and made shipments of gold bullion, the property being confiscated by the Government on a charge of taking gold out of the country without a license to do so. The machinery was purchased by the Hays Co. and moved to the Pineta Mountains after the property had reverted to the original owners.

Magdalena is about 50 miles south of Nogales, on the railway, and about 50 miles east of Magdalena the Dolores and Santo Domingo Rivers unite to form the San Miguel River. Above the junction, in the canyon of the Santo Domingo, is the great placer gold field that bears the name of the river, and farther up the stream is another field of auriferous deposits known as La Brisca. Both these fields are contained in the holdings of the Greene Consolidated Gold Co., of New York—the area including 15 miles of known gold-bearing material along the channel of the river, together with gravel benches on either side, long celebrated as rich placer ground. These deposits of gold were derived from the erosion of innumerable ledges in the

mountains surrounding this valley, known as the Caliche, Sierra Azul, and Santa Rosalia Mountains, forming a great natural basin drained by the river. This region has been described by Dr. Robert T. Hill, of the United States Geological Survey.

The river has cut its channel through a formation of yellowish tufaceous material to a depth of from 100 to 400 feet. The main channel has numerous collateral feeders which extend from the gold-bearing veins to the central channel, and have also cut numerous canyons from 30 to 100 feet in depth. Geological indications are that the basin was once dammed by a barrier at its lower end (since removed by erosion), which formed a lake, upon the bottom of which was gradually deposited a bed of reddish gravel from 40 to 100 feet deep, carrying gold. As erosion continued, the deposits of gravel were removed from the benches and distributed upon the bed of the river to their present depth of from 40 to 60 feet of pay gravel upon bedrock, which many tests show to run from $0.70 to $12 per cubic yard.

This section of the country was noted as one of the sources of the great supply of gold which during the early Spanish colonial times poured across the Sierra Madres to the viceregal court at Mexico City, and thence to the royal treasury in Spain. Before that time it was the source of much of the gold that the Aztecs had accumulated. The beds of the canyons in the surrounding country were worked by the Spaniards and their Indian predecessors, who, however, were unable to handle the immense volume of water in the river channel and percolating to the bedrock (the surface flow is never more than 200 miner's inches, and the underground flow is much greater).

The Greene Consolidated Gold Co. has thoroughly tested and explored this ground for a distance of 14 miles, sinking shafts to bedrock, running drifts, and proving that this gravel gives uniform values throughout the zone not worked. In 1904 the company installed steam shovels and aerial tramways to move the gravel and dump it into the sluice boxes, and heavy pumps were installed to take care of the water and utilize it for the washing process.

In this same region are found several producing gold mines, among them the Caliche, the Klondyke, the Tucabe, etc., all of these having been abandoned during the recent revolutions in Mexico.

### CERRO PRIETO MINES.

The Cerro Prieto mines are located within a few miles of the confluence of the Dolores and Santo Domingo Rivers. The properties include a group of mines combining an area of 102 "pertenencias." The name "Cerro Prieto" is applied to a lofty ridge of dark limestone, about 7,000 feet in length, rising about 1,000 feet above the mill site at its southern base. Through the ridge runs a great porphyry dike, varying from 10 to 100 feet in width, all mineralized, and carrying gold in quantities sufficient to pay well when handled on a large scale. The rock is soft, friable, easily milled, and the gold is readily separated. Tests in the entire 7,000 feet of rock show values running from $1 to $8. The property has been operated by a series of tunnels. A 20-stamp mill was in operation for several years and was replaced by one with a capacity of 200 tons daily.

### PROVIDENCIA GROUP.

About 7 miles northeast of Cerro Prieto is the Providencia group, very similar to the former in general characteristics. Beyond that, still to the northeast, is the Caliche mine, a great mountain of low-grade gold ore.

Beyond the Caliche mine, some 8 or 10 miles across the Santo Domingo River, lie the Klondyke and Tucabe camps. In the vicinity of the Klondkye mine is an old "antigua" called Rey de Oro which shows extensive workings. It has a wide ledge, varying in width from 10 to 30 feet, carrying free-milling gold values. A long tunnel was driven along the ledge to cut under the old workings, and good values were shown for a large-capacity plant. There are many good prospects in this neighborhood.

Down the San Miguel River, just below the union of the Dolores and the Santo Domingo to form the first-named stream, is the town of Cucurpe, the site of one of the most important mining centers in colonial times. About 9 miles west of Cucurpe lies the La Higuera gold region, where extensive operations were carried out in early times by the Spaniards. There was once a large town, as is shown by the vestiges of buildings and the ruins of scores of stone "arrastres" for grinding the ore. The formation is of limestone and porphyry, between which runs, in north-and-south direction, a great dike nearly a mile long. The rock material of the dike includes lime sulphates and quartz, and bears evidence of having been finely crushed and broken and impregnated with gold solutions. Present development is mostly by tunnels, which have exposed an 18-foot ore body that mills from $6 to $15 per ton. The properties were organized by the Brady-Levin Co., of Nogales and Tucson, the cost of development being defrayed in part by the product of a 5-stamp mill.

Passing down the San Miguel River one finds good mineral regions in the mountains on either side, and westward toward the railway there are the Animas, Santa Barbara, and a number of other mining properties, with any number of old mines awaiting new and modern development. At Llano Station on the railway is the San Francisco mine, a gold property upon which a 10-stamp mill has been steadily working for a number of years, operations being only curtailed by the 10 years of revolution in Mexico. In the immediate vicinity is the Los Rieles gold property, which has some promise.

### URES DISTRICT.

At Tuape the San Miguel River passes into the Ures district, one of the richest in natural resources in Sonora. Eastward from the town are the extensive copper properties of the Richfield Mining Co., upon which considerable development work exposed large bodies of valuable ore. There are many prospects in this vicinity.

Westward, toward the railway, is the Querobabi region; here there are a number of promising mine prospects, some of which are being developed.

Farther down the San Miguel River, in the region of Opedepe, is the San Ricardo, a gold mine with a record of rich production going back to the "antigua" days. It was operated by an American company 30 years or more ago, a 20-stamp mill being on the property. The mine was confiscated by the Mexican Government for

nonpayment of gold export taxes. Another American company has erected a new 20-stamp mill on this property.

West of the San Ricardo is the Minas de Oro property, which is equipped with Huntington mills and is a good shipper of high-grade ores. Near by is the Santa Gertrudis, a good gold producer, and also the Amarillas, a silver property with a record extending back to colonial times and also rehabilitated by modern methods. South of the Santa Gertrudis is the famous Socorro mine, with a great record of production since colonial days. In 1903 this property was purchased by experienced Colorado miners who unwatered and cleaned out the old workings and developed the property into a fine producer of milling and shipping ores. From the San Ricardo and El Oro mines the solid granite is cut by numerous ledges throughout an area of 5 by 15 miles, all of which show gold values and also silver-ore outcroppings.

A few leagues down the river from Opedepe is the town of Rayon, the center of another important mineral region, in the vicinity of which are the properties of the Palo Alto Mining Co., which make a good showing in copper. Below Rayon is the San Francisco mine, an old mine which is yielding handsomely despite the ancient methods of ore-value extraction.

The seat of the local government of the Ures district is about 50 miles from Hermosillo, the town having about 2,000 people. Over on the southeast, toward the Matape River, are the Chipiona and Colorada-Ures mining regions, a few miles northwest of the town of Matape. There lead and silver predominate. Ten or a dozen miles directly south are the Marquesa and Quincy properties. The former is owned in Hermosillo.

In the southern edge of this district, directly south of Ures, is the Llano Colorado region, famous for its placer diggings more than a century ago. An American company has been successfully working this ground by the hydraulic process. A few miles to the west are the Realito mines, where extensive ancient workings and the ruins of more than 100 "arrastras" tell of a great production in colonial times. The Los Angeles mine in this vicinity was shipping high-grade silver ores in 1904 and later.

A day's ride west of Matape (the latter place being a long day's ride from Minas Prietas), Suaqui de Batuc is reached at the confluence of the Moctezuma and Yaqui Rivers. Along both rivers are rich mineralized regions. Southeast of Batuc are the Santo Niño mines, owned by the Yaqui Copper Co. More than $1,000,000 was raised for their exploitation, but lack of harmony has stopped development.

In the vicinity of Batuc are the Todos Santos, El Cajon, Zaragoza, Estrella, and other good properties, several of which have been developed.

Overshadowing Batuc, a town about 2 leagues up the river from Suaqui Batuc, is the famous Lista Blanca Mountain, wherein a lacework of rich silver veins ramify to great depths and have been worked continuously for almost two centuries. There are also copper and quicksilver indications and deposits in this same mountain.

### COPETE MINING REGION.

About 7 miles southwest of Rayon is the famous Copete region, where the Copete Mining Co. has extensive holdings. Adjoining the

Copete is the Sultana mine, the property of the Giroux Consolidated Mining Co., of New York. Beyond the Sultana property is that of the Colorado mines, having several thousand feet of tunnels and crosscuts in low-grade gold ores.

### MINAS PRIETAS GOLD MINES.

The Minas Prietas gold mines are located in the Hermosillo district 12 miles from the railway, over the Torres & Prietas Railway, a narrow-gauge line. These ore bodies were worked more than 160 years ago. Records show that in 1743 these mines were being worked by the missionary priests at great profit, but Indian troubles forced their abandonment until they were again worked by venturesome miners in 1790. The mines were afterwards abandoned when the heavy water level was reached, the only means of pumping a mine then being by means of rawhide buckets ("surrones") carried on men's backs up notched tree trunks for ladders from one short level to another. Many profitable mines have been secured in Mexico by studying the history of the old colonial mines and installing powerful pumping machinery on those that had a heavy water flow underground.

In the sixties the Minas Prietas gold mines were worked by an adventurous American, Don Ricardo Johnson, who is still alive and active in mining in Sonora. He pumped out and worked the Creston and Prietas mines of this group and later sold the latter to an American company which installed a 40-stamp mill at a cost of $300,000 and recovered several millions of dollars. In 1886 these holdings and others of that company passed to the Creston-Colorada Co., of Cleveland, Ohio, which operated continuously up to the advent of the revolutionary period in Mexico, producing several millions of dollars in net profits annually. These mines later passed into the hands of a New York syndicate, said to be headed by John W. Gates, at a price said to have been $5,000,000.

In 1890 great ore bodies were developed in the Grand Central, Amarillas, and other properties, in a ledge running parallel to the one in which all former successful mining operations had been carried out, and another great enterprise was launched in this camp.

Two great companies operated at Minas Prietas—the Creston-Colorada and the Grand Central. The Creston-Colorada Co. owns the Prietas, Fortuna, Creston, Colorada, Don Ignacio, and several other properties extending for a mile or more along the main ledge. The Creston, Fortuna, and Prietas mines are at Minas Prietas proper, and the Colorada and Don Ignacio at La Colorada, about a mile distant. At La Colorada is the mill, consisting of a 30-stamp mill, 6 Huntington mills, 9 amalgamating pans, 16 Frue vanners, and cyanide plant, with a total ore-handling capacity of 200 tons daily. Ore is brought to the mill from the Prietas and Creston mines by an overhead wire tramway.

In a subsection of the camp, locally called La Primavera, adjacent to La Colorada, is the seat of operations of the Charles Butters Co. (Ltd.), lessee of the Grand Central properties. The mill has a battery of thirty 900-pound stamps, 6 Huntington mills, Frue vanners, pans, etc. The camp is supplied with water from the Matape River, 20 miles distant, by means of a pumping station and pipe line, the station being near the town of San Jose de Pimas.

The country rock of this region is a hornblendic diorite, capped by a quartzite, except where, between the higher hills, erosion has cut away the cap. Upon one side or the other of the quartzite are dikes of quartz porphyry, the mineralized veins appearing both as contacts between the dikes and the diorite and also as independent veins traversing the diorite itself. The veins vary greatly in width, narrowing in places to 2 feet, and at others measuring in width 100 feet or more. The largest and most productive ore bodies are often found at the junctions of the veins with tributaries. The gangue consists of quartz and altered dike matter, and even of the diorite mineralized. The ore occurs in detached bodies of irregular shape and varying greatly in size, occurring in such relation to each other as to form chutes easily worked and readily handled. The ore is principally quartz, carring various amounts of pyrite, chalcopyrites, and galena. The proportions of gold and silver in the ore vary considerably, but the combined product of all the ores worked is a mixed bullion—about 65 per cent gold and 35 per cent silver.

There are many more properties in this section capable of becoming producers, with intelligent handling and large reduction plants. The properties of the Compañía Unión Minera are described as belonging to this category and have been negotiated for by a strong American syndicate. The Bastilla is another property on the same ledge as the Prietas mine, adjoining the Fortuna on the south; on the Bastilla extensive development showed a large body of milling ore.

About 12 miles northeast of Minas Prietas is the Zubiate group, where there are rich silver mines with a record of production going back to the early Spanish days. In 1898 or 1899 the property passed to a California group which opened new ore bodies and erected a 5-stamp mill and plant for their treatment. This mill was destroyed by fire and a new one of 40 stamps was erected to replace it. The stamps with amalgamation failed to save sufficient values, and grinding mills, dryers, and roasters were installed, the pulp going from the latter to the pans.

About 25 miles west of Minas Prietas, and westward from the line of the railway, are the Tarasca mines, where another "antigua" camp sprang to life under modern mining methods. The ancient workings were very extensive and had followed rich ledges for great distances. Some miles away, at a place called Aguaje, there are the vestiges of the old mining town, church, etc., and reduction plants, piles of tailings, and old "arrastras," showing where the ores from La Tarasca were parted from their values by the colonial miners, employing their crude methods. The present owner is a California company, which has run shafts and tunnels under the old workings and developed large bodies of excellent ores, much of it sufficiently high grade to permit shipping directly to smelters in the United States without treatment.

In the region between Minas Prietas and Hermosillo are the Dewey mine, Mina Grande, and a number of other good properties. North of the Zubiate group are the Tortuga, Constitución y Italia, Last Chance, Santa Rosa, and Las Cruces mines. The Last Chance is a mountain of low-grade gold ore.

About 40 miles northwest of Hermosillo are the Verde Grande and El Mojin properties. The Verde Grande erected a 100-ton smelter "blown in" in 1905.

### YAQUI RIVER DISTRICT.

The Yaqui River country was for ages the fabled country of Mexico for miners and prospectors, and many are the tales of adventure, rich strikes, Indian fights, lost mines, and all that goes to make a story of the Great West. One hundred miles south of Hermosillo, the capital of Sonora, lie the Sahuaripa and Alamos districts, which contained many of the old mining camps of colonial days, when these regions were the most populous and richly productive in all New Spain. West of the river, in the Hermosillo and Ures districts, are also rich and extensive mining regions with historic records, capable of swelling the volume of production of precious metals. In these regions may be included such mines as those at the camps of San Javier, La Barranca, Los Bronces, San Antonio de la Huerta, Las Goteras, Cerro Colorado, San Juan Grande, Soyapa, etc.

At San Javier the Gold Coin Mining Co. has a 30-ton copper smelter, producing a high-grade matte, rich in gold and silver values. This company owns the Santa Rosa, a famous "antigua" mine. At the same place the Wyman Mining Co., operating the Animas mine, erected a 50-ton concentrating plant. The Verde Grande is the large copper property near San Javier.

At Toledo, on the west bank of the Yaqui River—only a few miles from the various camps mentioned in the two preceding paragraphs, which are located within a radius of 20 miles—the Yaqui Smelting & Refining Co., a Toledo (Ohio) corporation, has established a large customs smelter.

One of the advantages of the region of which Toledo is the center is the existence of large bodies of a low-grade anthracite coal and natural coke at La Barranca, only 6 miles from the Toledo plant. Development of these coal deposits was conducted for several years by the Sunset Development Co. (Southern Pacific). Another coal field is known to exist about 40 miles distant, beyond the Yaqui River, in the Sahuaripa district, previously mentioned as having been the scene of active mining operations in colonial days.

### SAHUARIPA DISTRICT.

The Sahuaripa district includes such properties as the famous Trinidad, La Bufa, Mulatos, Cieneguita, Tayapa, Ostimuris, Tejada, Tonichi, Santo Niño, and many other noted mining regions where the remains of towns and reduction plants bear every evidence of former large populations, and the old records show that they poured forth a constant stream of silver and gold during two centuries.

The Tonichi copper properties are owned by the Tri-Metallic Mining Co. and are situated about 10 miles east of the Yaqui River, beyond Toledo. The property consists of a great ledge of copper ores carrying gold and silver values, which are being developed by a system of tunnels. The vein is 70 feet wide in places, following the crest of a lofty ridge.

Southeast of Tonichi (a long day's ride) lies the great Trinidad and La Bufa region, which attracted great attention in 1906 and 1907 on account of the building of the Tonichi branch of the Southern Pacific Railroad of Mexico, which was planned to afford rail transportation to the border and connect with the large smelters at Douglas

and other places, making practicable the working of lower-grade ore which is obtainable in this region in very large quantities and great bodies. Within a radius of a few miles from Trinidad and La Bufa are 125 known "antigua" mines that were producers in the past, and the operations of the La Bufa Mining & Reduction Co. show what can be done. At a depth of 600 feet ore bodies of gray copper were opened up which were shipped on pack mules 150 miles to the railway station at Torres and thence to El Paso, where they paid from $200 to $600 per ton net profit. The success of this property has been curtailed only by the last period of revolution in Mexico.

About 15 miles from La Bufa is the Trinidad property, once the largest producing silver mine in Mexico. It is owned by the same people controlling the La Bufa group of mine properties, and considerable modern development work has been done on it.

A day's ride (approximately 40 miles in a fairly level country) northeast of Trinidad are the famous Mulatos gold mines, owned and operated during times of peace by a Pennsylvania corporation.

Directly north of Trinidad (two days' ride) are the properties of the Cineguita Copper Co., which have been declared by experts to be among the greatest mineral deposits in the world. The company's holdings include three mine groups—the Chipiona-Cieneguita, the Ostimuris, and the Tayopa. The first named comprises seven great ledges included in an area 2½ miles long by 1 mile wide. In these ledges old workings are frequently found running the entire distance of the ledges and connected underground for hundreds of feet. In the old workings are left exposed many thousands of tons of rebellious ores, and the company has blocked out in the new workings immense ore bodies of high-grade copper sulphide ores carrying gold and silver values. One of the bodies developed is 23 feet wide and another 39 feet wide. It was estimated that the two ledges developed 2,600,000 tons of ore that would yield 5 per cent copper, 60 ounces of silver, and from $3 to $8 in gold per ton. Other ledges carry galena, with paying values in gold and silver. Besides the showing in the old colonial workings the Cieneguita company has developed ore bodies in new ground with 13 tunnels from 300 to 1,000 feet long.

### ALAMOS DISTRICT.

The famous old Alamos mining region adjoins Cieneguita on the south. At the city of Alamos were made up the great mule "conductas" loaded with gold and silver bullion which traversed the Sierra Madres once a month to Mexico City. The old trail across the high and rough mountains is still to be seen in places, cut into the rock by passing hoofs, with here and there the ruins of the old guardhouses. Iron and steel were then worth more than silver, which was often used to shoe the mules with.

In the immediate vicinity of Alamos is the famous Quintera mine, from which a great fortune was taken by the Almada family. After more than a century the mine was taken over by a French syndicate.

At a point 45 miles to the northeast of Alamos is an extensive iron deposit, estimated to contain, by actual measurement, 16,000,000 tons of iron ore. In its origin and general character the ore in sight is a duplication of the famous iron mountain of Durango City, only somewhat smaller. It is a great mass of iron which has come up with porphyritic and rhyolitic rocks, in which are found the principal

mineral deposits of this region. It is but 50 miles from the anthracite coal deposit at Pilares, which is particularly adapted for smelting this ore, and the vicinity affords an abundance of flux materials.

The following is an analysis of the iron ore located here:

| | | | |
|---|---|---|---|
| Silica | 1.27 | Phosphorus | 0.29 |
| Manganese | .31 | Ferrous oxide (metallic) | 13.156 |
| Sulphur | Trace. | Ferric oxide (iron) | 67.33 |
| Alumina | .27 | | |

There are literally innumerable mines in the Alamos district. At Baucari and Trigo are rich gold mines. At El Cerrito are rich placer mines, while at Baroyeca and Piedras Verdes are large copper properties, and at La Dura steadily producing silver mines, which have been in modern operation for a quarter of a century and have reached a depth of 1,200 feet. The last-named mine is located in the extreme northwest corner of the district, about 120 miles from the Sonora Railway, at Ortiz.

### GUAYMAS DISTRICT.

There has been considerable mining in the region a few miles south of La Barranca and San Javier, but the long-continued Yaqui Indian troubles have curtailed modern development of this district. Near Suaqui Grande on the Tecoripa River, a day's journey on mule back westward from La Dura, the Chicago & Sonora Gold Placer Mining Co. had in operation a gold dredge, and other dredgers were being planned and constructed. This placer field extends along the Tecoripa River from Suaqui Grande to the union with the Yaqui River at Cumaripa, a distance of about 30 miles, and there is also a good placer field along the Yaqui.

At Batamote, west of Suaqui Grande, the Ruby Gold & Copper Co. has been operating valuable copper mines, reducing the ores in a reverberatory furnace.

At San Marcial, between Batamote and Ortiz, are extensive coal measures upon which considerable development work has been done. The field extends toward the Hermosillo district, and at La Lapiz the United Graphite Co., of Saginaw, Mich., has opened deposits of high-grade graphite, from which shipments have been made to the United States.

The graphite industry is centered in the mountains between La Colorada and Ortiz, the leading companies being the United Graphite Co. and the National Graphite Co. The first named is operating three properties and has loading facilities at Torres, Escalante, and Moreno on the Southern Pacific of Mexico Railroad. Generally depressed conditions in the United States following the fall of 1920 adversely affected this mining industry in Sonora, and toward the end of 1921 little graphite was being shipped to the United States. The operators have experienced great trouble from the Yaqui Indians, at one time losing 80 mules used for transportation of the product to the railway. The property of the National Graphite Co. (Lewis Gilman & Moore, Inc.), of San Francisco, is located 20 miles from La Colorada, at Cerro Colorado. The product is an amorphous graphite. The present producing capacity is 10 tons daily. Recent shipments totaled 1,000 tons, valued at $50 000 United States currency

The El Lapiz deposits lie just south of La Colorada and have produced 80 per cent of the graphite used in the United States for some years. In 1918 the production was 80 tons daily. Geologists claim that these graphite deposits have a close geological connection with the coal formations at San Marcial and San José de las Pimas.

In the Bacatete Mountains, southwest of Ortiz, is the Bonancita region, noted for its gold quartz ledges and placers.

Returning to Hermosillo and going up the Sonora River one reaches again the Ures district. At the distance of a day's ride northeast from the city, and about the same distance southeast from Copete, is the Gavilan region of colonial fame. There the Ures Consolidated and the Vega mining companies have been operating valuable properties, the former having a 10-stamp mill.

### LAMPAZOS SILVER REGION.

About 45 miles east of Batuc is the Moctezuma district, another region with a history of production going back to the eighteenth century. The ledges are wide, well defined, and strong, and by adits have been explored to a depth of 1,000 feet, or more, below the outcroppings. There are workings in two of the great ledges, which cut into a lofty ridge, from which they can be seen extending down the west side for several miles. Parallel thereto are several other large ledges that bear external evidence of being very similar. Only a few miles from Lampazos, on every side, are numerous "antigua" mines and workings and the ruins of old camps, which show that the region must have been one of great mining activity in the old days of the Spanish Conquest.

To follow the Moctezuma district up to the American border at Douglas, a distance of some 200 miles, and enumerate all the old mines ("antiguas") and the ancient and modern mining activity of this region would fill volumes.

### MOCTEZUMA DISTRICT.

The Moctezuma district was one of the noted, rich producing regions of the early mission days, and its mines are now included in the list of the world's great properties. To-day, at Nacozari, there is a great copper property, rivaling Cananea, and connected with the American system of railways at Douglas, Ariz., about 80 miles away. These mines are under the same ownership as the Copper Queen at Bisbee, the Indiana-Sonora group at Cananea, and the Globe and Morenci properties north of the Gila River in Arizona (Phelps-Dodge Corporation). A narrow-gauge railway connects the mines with the plant and reduction works at the town, a distance of 7 miles. The combination concentrating and smelting plant had a capacity of 200 tons per day in 1904 and has since been greatly increased by the addition of more machinery. A new concentrating unit was completed late in 1922, which brought the daily capacity up to 1,400 tons, the new plant having a capacity of 700 tons per day. By the end of 1922 the Moctezuma Copper Co. at Nacozari was employing 1,800 men, after the resumption of operations following the long shutdown due to the effect of low copper prices and labor troubles in Mexico. Two units of the concentrator plant were being operated,

and the product was being shipped to the Copper Queen smelter at Douglas for final reduction into matte.

The ores handled run about 3½ per cent copper, with an extraction of 96 per cent by the most modern methods. At the mines at Pilares there has been developed recently what is termed the largest copper-ore body in the Southwest. The property is tapped by a tunnel which reaches the 660-foot level of the main shaft in a distance of about 1 mile from the portal. This tunnel runs around the edge of a pear-shaped ore lens. The main ore body is said to be 3,200 feet long and 1,000 feet wide, and drilling has shown that it reaches an additional depth of 1,500 feet below the present level. The Copper Queen smelter at Douglas was built 20 years ago and is the largest in the southwest of the United States. The plant is to be greatly increased and modernized and a silver furnace added.

In the Huacal region, east of Nacozari, are many of the old, famous "antigua" mines, among them being the Huacal, Doña Maria, Churunibabi, and many more. Several strong American companies have taken over the best of these properties, and there are several independent reduction plants, in operation for many years.

Sixty miles northeast of Nacozari, and beyond the Bavispe River, is the Pilares de Teras region, where the Cinco de Mayo and the Roy mines have long been valuable producers. Not far away is the famous El Tigre mine, a comparatively modern discovery on which a mill of 100 tons capacity was erected in 1904. This property is very rich in gold and silver and has made fortunes for its owners—all western mining men. The company is known as the Lucky Tiger Combination Gold Mining Co., of Douglas, Ariz. The annual report for 1920 showed an operating profit of $1,535,478 and a net profit of $792,201. Returns were less than for the preceding years, on account of the low prices of silver. The ores contain gold, silver, copper, lead, and zinc. Up to 1920 11,217 feet of development work had been done. The company is capitalized at $8,000,000, with a total of $7,153,370 in stock issued. It was organized in 1903 at Kansas City, Mo. Paid dividends to and including 1920 amounted to $7,469,572 United States currency. The same company is also developing mines near Ures, southeast of Nacozari.

Two or three miles away are the San Juan mines, nearer to Pilares de Teras, where development work forecast a property rivaling El Tigre.

### ARISPE DISTRICT.

The Moctezuma district occupies the extreme northwest portion of the State of Sonora. To the west, lying between that and the Magdalena district, is the Arispe district, in which are the great copper mines of Cananea. The district is drained by the Sonora River, which rises near the international boundary, flows south for about 150 miles, then turns in a southwesterly direction, passing Hermosillo and Ures, toward the Gulf of Lower California.

The municipality of Arispe, the seat of the local district government, on the Sonora River, was a place of great importance in early Spanish days. The present population is less than 1,000. Remains of dwellings, churches, and other structures show that it was once a city of real importance, and its population is recorded as having reached 35,000. It was the center of great colonial smelting and

refining operations, as shown by the ruins of many crude furnaces and by the existing slag dumps. It was the seat of the colonial government of the Royal Provinces of Sonora and Sinaloa during the reign of Philip III of Spain, the King's governor being a royal appointee and semi-independent of the viceroy at Mexico City. All the old land titles of the West Coast of Mexico emanate from this primordial source of royal land grants. The church, dated 1710, had altar values reaching half a million dollars.

About 15 miles west of Arispe, and 60 miles from the railway at Imuris station, are the Santa Rosalia gold mines, operated extensively by the colonial Spaniards, their reputation having been justified by recent development of these mines by a California company started in 1896. The mines were deserted at the time of the great Apache uprising in 1822, and the tunnel leading into the richest ore was closed and concealed. When it was discovered and the various doors opened, an ore vein was found, 12 feet wide, running $20 of free-milling gold to the ton, and a rich streak 2 feet wide carrying values which netted $24,000 for the first carload shipped to San Francisco, $18,000 for the second, and $22,000 for the third carload.

North of Arispe and west of Bacoache is the Picacho mine, owned by the Douglas brothers, of Bisbee and Nacozari. This rich mine was discovered by a Mexican miner in 1898, has since yielded a great deal of money to its owners, and is still producing.

In the vicinity of Bacoache are extensive placer grounds, and in the Ajo Mountains, northeast of Bacoache, considerable prospecting work on a large scale was being done prior to the recent revolutionary period in Mexico.

Southeast of Arispe are the famous Chispa and Carmen mines, with long records of profitable production.

Half a day's ride down the river from Arispe, near the town of Banamichi, is the Santa Elena mine, a gold property with a great record of production of several millions of dollars. Sixty years ago it was owned by Gen. Ygnacio Pesqueira, the great Mexican Liberal leader, who was the right-hand man of General Diaz following the troubled times of the French intervention in Mexico. From the Santa Elena mine he obtained most of the funds with which he waged war with the reactionaries and the terrible Apaches. General Pesqueira sold this mine to an American company which erected a large mill and operated it on an extensive scale. In 1894 it passed into the hands of an English syndicate. It has been shut down since 1900 and has filled with water. In character of ores, general formation, etc., the Santa Elena is a counterpart of the Minas Prietas mines. To take over this property, pump it out, and rehabilitate it would require a heavy expenditure of capital, but it is thought that the history of the mine alone would warrant the venture.

About 20 miles below Banamichi is Huepac, where a Milwaukee company has considerable property and a small reduction plant.

### ALTAR DISTRICT.

The Altar district comprises a very large area, extending nearly 300 miles along the American line and several hundred miles along the gulf coast to the west. This district was noted for the richness of its great placer deposits, even before the days of the Spanish

occupation of the territory. It has numerous gold ledges where some of the richest "antigua" mines were developed, some of which have been in successful operation in more modern times. The Altar district is the most arid in Sonora, and mining operations are greatly hampered and restricted by the lack of sufficient water supply. Dry washers have been employed with considerable success.

At La Cienega, about 75 miles southwest of Santa Ana Station on the railway, is an extensive placer field where it has been proposed to develop water for washing by sinking wells. North of La Cienega, near Caborca, is another placer field called Las Palomas. In the vicinity of El Tiro, El Cajon, Cerro Colorado, and many other localities are other placer fields which have been worked over and over again and which have constituted a means of livelihood for many hundreds of poor people while the mines in Sonora were shut down during the years of revolution. West of Llano a Texas company has successfully operated dry placers with improved machinery.

In quartz mining the Altar region has also been famous. The great El Tiro ledge is traced for a distance of 20 miles in a north-and-south direction. At El Tiro, on the northern end, the Reina de Oro Mining Co. has sunk several shafts to a depth of from 400 to 600 feet, connected by levels every 100 feet, all in good free-milling ore 6 feet in width. At El Cajon de Amarillas at the southern end, 20 miles away, the Yerkes Gold Mining Co. has large bodies of free-milling ore and a 20-stamp mill in operation.

Between El Tiro and La Cienega lies Cerro Colorado, which is almost literally a mountain of ore. This property has been worked for years, the workings following rich streaks and stringers of gold rock, which was reduced at a small three-stamp mill near La Cienega, leaving exposed more than a million tons of good ore running $5 per ton.

Nine miles west of the town of Altar is La Cuchilla, where the Rey del Oro Mining Co. had three Huntington mills in operation.

West of Magdalena Station on the railway is Tubutama, where the Sonora Milling & Mining Co. developed a copper property and installed a smelter in 1903. This company later acquired the Juarez gold mine 30 miles from Caborca Station. This property is an "antigua" worked for ages as placer ground by the Pápago Indians who occasionally found very large nuggets, one of which weighed 38.8 ounces. In 1881 the erection of an amalgamation plant by San Francisco people did not give the required result, as the fine flour-gold values were lost, and a new cyanide-process plant was installed with excellent results.

At La Calera, about 9 miles west of Caborca, the Arizona-Mexican Copper Co. has developed the El Gran Proveedora de Cobre.

Over on the gulf coast at San Jorge Bay and at Quitovac the Sierra Pinta Mining Co. has in operation two gold properties which are connected with their reduction plant at San Jorge Bay by a narrow-gauge railway about 13 miles long.

Near El Plomo and San Francisco, in the extreme north, near the Arizona line, valuable gold properties have been in operation and copper mines are in the course of development.

NOTE.—The above general description of the mines and mining regions of the State of Sonora gives an idea of the very great possibilities of the West Coast as a mining country, the development by foreign capital since the eighties, and what is being

done by the application of modern methods and machinery on properties formerly thought to have been exhausted by the colonial miners who took the cream of the high-grade ores.

This development represents the investment of many millions of dollars of American capital in Mexico, and it was again going forward in the fall of 1922, in consequence of the era of peace in Mexico following the advent of the Obregon administration. Many good properties were abandoned during the years of revolution after 1911 and their titles lost by the nonpayment of taxes, or through other causes. The work of rehabilitating the mining industry of the West Coast of Mexico is going forward; abandoned mines are being reopened, and prospecting for new mines is again becoming active. California and Arizona mining men are well acquainted with the West Coast territory as a mining and mineral field and have been interested for years in its development. During the past year American mining engineers have been carefully examining (with a view to purchasing) old properties, with records of production, that have been closed down on account of revolutionary conditions. They are also looking into new prospects and offerings all over the West Coast. A dozen men representing large mining companies of the United States, principally those interested in Arizona and Sonora, were in Nayarit in the fall of 1922.

### MINING IN NOGALES DISTRICT.

Following is a discussion of mineral deposits and mining industry, submitted by the American consul at Nogales, Sonora, under date of February 1, 1922:

Mining is the principal industry of this district, but there are no publications devoted to it and no official statistics, except the declared-export returns in consular invoices. The principal mining companies have their head offices in the United States, and their annual reports are available. Some of the gold and silver is not accounted for in the consular invoices. It is known that some placer gold is produced, but none was invoiced during the past year, it being handled by small traders at the border in an irregular manner and in small amounts. Some of the metals and mineral products shipped through this port of entry into the United States—especially gold and silver—originate in other consular districts.

Copper constitutes the principal mineral product of this district. Silver, lead, zinc, gold, and other metals are mined. Graphite is also mined just south of this district, and there are deposits of molybdenum, tungsten, manganese, and antimony ores which it does not pay to work at present. Small quantities of platinum and quicksilver are occasionally reported as having been found.

There seems to be no coal in this district, but at San Javier, near the end of the Tonichi Branch of the Southern Pacific Railroad (up the Yaqui River from Corral, and not now in operation) there is very good coal, and when that portion of the railway is rehabilitated it is likely that this coal will be made available. At present it is used only at the silver mine and smelter which an American company is operating in that vicinity. Other mineral products of the district include some brick, lime, and sandstone for building. The latter is usually quarried at or near the site where it is to be used. Stone used for building is of poor quality and shows the effect of weathering conditions.

Gold, silver, copper, and lead have been the principal objects of the prospectors, and little attention has been paid to other metals and minerals. When found, they have often been in localities more or less inaccessible or they have not promised a profit on account of the lack of demand for them.

The total value of mineral production in 1921 (from consular invoices) was $8,059,952, against $21,646,575 in 1920. The production in 1920 was practically normal. The falling off of the metal output in 1921 was due to the depreciation in the price of silver, copper, lead, zinc, and other metals; to labor conditions growing out of the various Mexican revolutions; to taxation; and to other minor influences. Conditions had closely approached normal before the larger mines closed down on account of market conditions. Mining was being actively carried on, and the inflated war-time prices for metal products had receded to a point near normal.

There is a renewal of hope and confidence with the betterment in the metal market. Labor conditions are steadily improving and are better than they were a year ago.

At present all interests, including the Government and labor, are interested mainly in the probable resumption of mining. Taxes on metals formed the chief source of revenue of the Sonora State government. During the past the loss of revenue from this source has been keenly felt, and financial aid to the State has had to be extended by the National Government. Inducements have been held out to the mining com-

panies (mostly American-owned properties) to resume operations, and it is reported that concessions as to taxes and other matters have been made. There is no assurance, however, that when operations are again fairly under way there will not be legislation and executive decrees which will harass the industry and constitute new burdens.

Economically the considerations that are of importance are: The world's market for metals and their prices; the cost of labor; labor's general attitude; the cost of necessary machinery and supplies; and the transportation problem.

The year 1921 was marked by the absence of any significant development in the mining industry. It may be noted, however, that prospecting was continued; options were taken on properties, and the option holders in general then waited for possible recognition of Mexico by the American Government; and the larger mines which had closed down were having their reduction plants overhauled and repaired, and in several instances important additions were being made to the existing equipment to increase the capacity of these large plants.

The future of the mining industry in this district is bright. There exists much mineral wealth that is at present inaccessible on account of the lack of transportation facilities and the great expense entailed in road building, etc. There are also many mining prospects that only await the return of normal political conditions in Mexico to be developed.

Following is a list of the principal mining companies in the district:

Cananea Consolidated Copper Co.; Cananea, Sonora; American.
Demócrata Mining Co.; Cananea, Sonora; American.
Moctezuma Copper Co.; Nacozari, Sonora; American.
El Tigre Mining Co.; Moctezuma, Sonora; American.
Aztec Consolidated Mining Co.; Noria, Sonora; American.
Pedrazzini Mining Co.; Las Chispas, Sonora; Swiss.

The following statement gives the official Government figures of mineral production in the State of Sonora from the year 1893 to the year 1903, inclusive (values exported, in Mexican pesos):

| | Pesos. | | Pesos. |
|---|---|---|---|
| 1893 | 2,167,700 | 1899 | 6,129,350 |
| 1894 | 2,940,450 | 1900 | 6,032,200 |
| 1895 | 4,517,500 | 1901 | 6,125,700 |
| 1896 | 6,511,850 | 1902 | 7,340,900 |
| 1897 | 5,896,250 | 1903 | 7,246,600 |
| 1898 | 6,691,450 | | |

Between 1903 and 1910 the mining industry received its greatest impetus in Sonora, with the great copper camps the largest producers of mineral wealth. Mexican Government records showing the production of the State during the period from 1910 to 1918 are not available, as they were destroyed during the revolutions. The following table gives the official figures of exports of metals during the calendar year 1918, taken from the records of the Federal assay office at Hermosillo:

| Metals. | Kilos. | Value per kilo. | Total values exported. |
|---|---|---|---|
| | | *Pesos.* | *Pesos.* |
| Silver | 228,753 | 64.00 | 14,640,196 |
| Gold | 1,235 | 1,333.00 | 1,645,666 |
| Lead | 3,717 | .30 | 1,115,140 |
| Copper | 46,346,467 | 1.20 | 55,615,761 |
| Antimony | 319,915 | .88 | 281,526 |
| Tungsten | 132,255 | 8.09<br>5.00 | 976,127 |
| Graphite | 6,189,149 | .16 | 990,264 |
| Manganese | 1,184,092 | .26<br>.23 | 288,929 |
| Molybdenum | 5,363 | 9.00 | 48,267 |
| | | | 75,601,876 |

NOTE.—The above table does not include all the gold exported.

## MINERAL DEPOSITS AND MINING INDUSTRY IN SONORA IN 1921.

Following is a report by the American consul at Guaymas, Sonora, dated February 10, 1922:

No official figures are available as to the total value of mineral production in this district for the year 1921. In a general way it can be stated that the production of silver, in ores or in bullion, as well as of gold, copper, and lead, was considerably less in 1921 than in 1920, because of the lack of demand for copper and the low prices of the various metals. The only mines in this district that were actively producing throughout most of the year were those of the Laughlin Co. at San Javier and the Progreso mine near Suaqui. The silver mines of the Compañía Minera de Minas Nuevas, at Alamos, closed down in the early spring, after renewing operations for a few months. The production of the Laughlin Co. also declined until at the end of the year it was nil. A few independent Mexican miners continued operations throughout the year, most of the product being handled through one agency, which reported handling 255 tons of ores containing gold, silver, lead, and copper, and 4,988 troy ounces of gold and silver bullion for the year.

Prior to 1913 the production in this district of the metals mentioned was of very considerable importance, but the industry has been affected by political disturbances until it has been practically paralyzed. Unsettled conditions, market prices for metals, transportation difficulties, and constantly threatening labor troubles were the chief obstacles met during the year.

The present trend of the mining industry in this district appears to be upward, according to the most authoritative reports, and it is believed that the activity during 1922 will be greater because of the increasing prices of copper and silver. Local conditions also appear to be more favorable to the mining industry. Yaqui Indian troubles seem to be at an end, for the time being at least, and the attitude of labor is more favorable than it has been during the period of revolutions through which the country has passed since 1911. Prices for necessary supplies and foodstuffs are much lower than at any time since the war.

In the summer of 1921 the Mexican Government removed the import duty on mining machinery, and export taxes on metals amounting to about 10 per cent were suspended to aid the industry. On account of the lack of wood or coal for fuel in many places of the district, the Diesel internal-combustion oil engine is the only prime mover that can be used to advantage.

There were no significant developments during 1921, except a more complete suspension of operations throughout the district. The indecision of capital with respect to furnishing money for development work, on account of the various unfavorable Mexican laws affecting the industry and the ownership of property in the country also hampered the industry, the ratio of inquiries for mining property in Sonora, as compared with former years, being about 1 to 25.

The Progreso mines are working a few men and a small mill. The La Colorada properties, a former "El Dorado," are now shut down. The Compañía Explotadora Internacional has been prospecting with churn and diamond drills for copper-ore bodies at Piedras Verdes, near Alamos, and favorable indications were reported to have been struck about the end of the year. The Hermosillo Copper Co. was doing some work in its mines at Mina Verde, 32 miles northwest of Hermosillo. At San Javier the company was merely holding the properties under guard, although this company continued operations all through the various revolutions and Yaqui Indian raids. A wagon road was being constructed from Ortiz Station, on the Southern Pacific of Mexico Railroad, to Suaqui.

At Santa Rosalia, in Lower California, the Compañía de Boleo, an important French mining company, continued operations on a reduced scale in 1921. It shipped to the United States 574,171 pounds of copper, valued at $51,577 United States currency, and 14,080,435 pounds of copper matte, valued at $683,007 United States currency. The company owns large deposits of copper ore lying near the Gulf of California. The plant includes seven reverberatory smelting units, and recent additions have been made, at a cost of about $1,000,000, in the form of crude-oil-fired converter plant, the company issuing bonds to cover this cost. Until 1921, coke for smelting came from the United States, but has now been replaced with crude oil. The company owns its own tank steamer for bringing fuel oil from Tampico and returning with copper for New Orleans or other Gulf ports of the United States. With the new improvements it expects to get good returns from the great piles of old slag on hand at the plant. Two hundred men are usually employed in the plant and about 1,200 men in the various mining operations. This property has been operated continuously since 1887, and in this

time has produced more than 100,000 tons of copper. Since 1916 all matte and black copper has been shipped to the Tacoma smelter. The matte formerly ran from 62 to 63 per cent copper, but in recent years a pyritic ore from Shasta County, Calif., has been mixed and used as flux, carrying about 2 per cent of copper. The present grade of matte is about 50 per cent copper. This matte is put into the reverberatories at Tacoma, and the black copper is charged into the converters. In 1921 and 1922 the monthly production of this company averaged 100 tons of copper per month, while the maximum capacity of the plant was 1,000 tons per month. The new oil-fired converter plant will obviate further shipment of matte to smelters in the United States.

## LOWER CALIFORNIA MINING NOTES: SOUTHERN HALF OF PENINSULA.

[NOTE.—The following data on Lower California were collected by Assistant Trade Commissioner H. B. MacKenzie, who visited La Paz.]

There are a number of old mines and mining claims in the southern district of Lower California, but none are being worked at present. Most of the claims are silver and gold properties. By far the most important properties are those owned by the Compañía Minera Peninsular, S. A., located at El Triunfo and San Antonio, the mines consisting of large veins of ores carrying gold, silver, copper, and zinc. A map of these mineral formations shows two heavy veins, the Triunfo and the San Antonio, as converging at an acute angle and dipping toward one another at angles of 32° and 55° from the perpendicular. The Triunfo vein runs in direction north, 30° east, and the San Antonio north, 8° west, the heavy outcroppings showing on the surface for a distance of 34,000 feet. There are 17 tunnels penetrating the ore bodies, the longest measuring 1,800 feet. Just to the east of the large formations are a great number of small gold veins heavy in arseno-pyrites, on the surface.

Various old workings were carried out in the Triunfo vein after 1850, and records show that the mines produced a total of 30,000,000 pesos prior to the great storm of 1895, when the mines were wrecked and filled with water. The present company has not been very successful in extracting a profitable production from these veins, and the properties are now under option for one year to the Compañía de Boleo, owner of the great copper mines of Santa Rosalia farther north along the Gulf of California coast.

### SALT DEPOSITS, CARMEN ISLAND.

On Carmen Island, some distance up the gulf from La Paz, are located what are said to be the largest salt deposits in Mexico. They are owned by the Salinas de Mexico (Ltd.), a British concern having its head office in Saltillo, State of Coahuila. This same company is said to own most of the existing salt mines and deposits of Mexico. The class of the salt produced on Carmen Island is graded as Extra and First Class. These deposits are said to be enormous and practically inexhaustible. Title is held under an old concession from the Mexican Government. Very little salt is being shipped at present to the mainland of Mexico, and then only as the market demands. Prices are $6 United States currency per metric ton at Carmen Island (1 metric ton = 2,205 pounds).

The reader will find on page 324 a reference to magnesite deposits on Margarita Island, Magdalena Bay.

## MANGANESE.

The Mexican Manganese (American; Frederick Stande, president, San Francisco, Calif.) owns 63 claims of manganese deposits at Concepcion Point, Lower California, near the port of Mulege, about 40 miles south of Santa Rosalia as well as 14 claims located 8 miles from San Nicolas Bay, near Mulege. Some British interests are located in the same region. In 1920, 200 tons of ore per month were being shipped to Chicago, the ore running from 20 to 92 per cent metallic manganese, and averaging about 48 per cent. Reports on this property made in 1918 showed that there were 362,000 tons of ore, averaging 46 per cent manganese, in sight. It was estimated that an expenditure of $100,000 would develop an additional 300,000 tons of ore. The freight on this ore is $15.86 per ton, via Guaymas, to which place it was planned to take the ore in lighters across the Gulf of California. The owners of this property have had interruptions to operations on acccount of litigation, and two years have been spent in perfecting titles, etc.

Manganese shipments from northern Chihuahua amounted to 1,721 tons, valued at $18,240, in 1919, as compared with 872 tons, valued at $26,938, in 1918. The low prices paid for this material in 1920 stopped all shipments from other parts of Mexico, although the demand for this metallurgical product continued on the part of the American steel and tube mills. The deposits occur at Concepcion very near to the ocean.

## LA SIRENA MINES.

La Sirena group of mines located at the port of El Barril, 113° west longitude and 28° 30′ north latitude (almost directly across the Gulf of California from Guaymas), on the peninsula of Lower California, near the manganese mines, have produced gold, silver, and copper ores, but have not been operated for a number of years, and capital is being sought for their development on a modern scale. They are owned in Mazatlan.

## MOLYBDENUM.

According to Bulletin 35, of the Mexican Department of the Interior, most of the developed molybdenum deposits in Mexico are in the State of Sonora. There is a large deposit in the Sahuaripa district, in eastern Sonora, the mineral occurring in rich deposits with scheelite and very large pieces of the pure metal. The Lucky Tiger Combination Gold Mining Co. has been shipping molybdenum ore to the Empire Smelting & Refining Co., of Deming, N. Mex., from El Tigre Mine, Moctezuma, Sonora. An American company has also acquired molybdenum deposits near Pozo, about 20 miles north of Hermosillo. Molybdenum is reported in several other parts of the State of Sonora.

A deposit of unknown value, located 35 miles from the port of Topolobampo, in the State of Sinaloa, is owned by an American.

There are several mines producing molybdenum ores in northeastern Chihuahua, Mexico. The existence of molybdenum ores has been reported from the Mexican States of Jalisco, Oaxaca, and Hidalgo, also.

## TUNGSTEN.

Prior to 1916 reports of mineral production in Mexico contained no mention of tungsten. In 1916, 115 short tons of tungsten ore, containing 60 per cent of $WO_3$ were imported into the United States from Mexico. In 1917 imports had increased to 340½ short tons. There are a number of deposits in the State of Sonora. The largest are reported to be located at a point called La Trinidad, in the Yaqui River district, in eastern Sonora. There are also deposits below Tonichi, on the Yaqui River which have been acquired by American interests. In 1915, scheelite, a tungsten ore, was discovered in the ores of the mines of the Washington Mines Development Co. near Huepac, 60 miles south of Nacozari, Sonora. The copper mines at Nacozari are also shipping some tungsten. Deposits of wolframite, a tungsten ore, are reported from Nogales and from Culiacan in central Sinaloa.

## SONORA PROPERTIES DEVELOPED SINCE 1904—PRESENT ACTIVITIES.

### LA BRISCA PLACER FIELD.

As has been stated, these placers were developed with modern methods by the late Col. W. C. Greene, of Cananea fame, but the titles were allowed to lapse on account of revolutionary troubles, and in February, 1922, the ground was relocated ("denounced") by a group of American mining people with headquarters in Nogales, Ariz. These placer properties are located on the San Miguel River, a confluent of the Sonora River.

### SAN GERONIMO MINE.

This property, also located on the San Miguel River, east of Poso Station on the railway, 100 miles south of Nogales, and owned by the El Tajo Mining Co., resumed operations in February, 1922.

### SANTA BARBARA MINES.

These properties, located about 20 miles south of Nogales, and owned by the Consolidated Arizona Copper Co., of Gary, Ind. (Phelps-Dodge interests), resumed mining operations on March 1, 1922. One thousand three hundred feet of new development work had been done on the main ledge. The ore carries lead and silver in addition to copper values.

### ARISPE SMELTER SCHEME.

For many years, on account of the numerous mines in this vicinity and the great variety of ores found, most of them low grade, there has been proposed from time to time a scheme to establish a large custom smelter at Arispe, which in colonial times had a population of between 25,000 and 35,000, all engaged in the mining industry, directly or indirectly. In February, 1922, certain mine owners having properties in this district again became active in the promotion of this much-needed smelter plant. When the railway was built south of Guaymas and the Tonichi Branch was constructed up the Yaqui Valley, tapping an old and rich mining country, a small custom smelter was erected at a point now called Fundicion, where ores for treatment could be concentrated from the Yaqui River country and from the south. The revolutions caused this plant to remain closed, and it is now partly in ruins.

### LAMPAZOS MINES.

This old property, now owned by Max Mueller and associates of the Banco de Sonora (see also Sonora Bank & Trust Co., of Nogales, Ariz.) has had a varying history of title litigation, etc., but operations were resumed on a small scale in March, 1922, by the present owners. This mine is located in the Nacozari region.

### DOLORES AND LA PALMA MINES.

The litigation connected with the ownership of these properties was finally settled in March, 1922, the properties reverting to their former owners, and work was recommenced.

### CERRO DE ORO MINES.

The Cerro de Oro mines are located near Carbo Station on the railway, near the Dolores mine, are owned by the Charles S. Mills estate, and have been operated for 20 years. Recent reports (March, 1922) were to the effect that new mining operations had resulted in striking rich gold ore running $6,000 to the ton.

### HIDALGO MINE.

The Hidalgo mine is located near Soyapa, in the Yaqui River country north of Tonichi. It was purchased by the Soyapa Silver Mines Co. and opened for operation and development work in August, 1922.

### WASHINGTON MINES CO.

This company owns properties 40 miles south of Arispe, on which work was suspended in 1916 on account of the unsettled conditions of the country, making further mining operations impossible. Operations were resumed in May, 1922.

### INTERNATIONAL MINES CO.

The International Mines Co. resumed operation of mines about 5 miles south of Nacozari in May, 1922. The mines carry a copper, silver, and lead ore.

### AZTECA MINE.

This famous old mine is located about 15 miles east of Alamos, and it is reported that $7,000,000 has been spent on its development from time to time. The ledge outcrops for 900 meters and rises 60 feet above the surface, the ore chute being well defined. Assays show copper running from 3 to 40 per cent, silver 3 to 33 per cent, and a gold value of $6 per ton. The property is now under option and is being offered to American mining interests. Los Angeles, Calif., capital is interested in the extension of this mine, known as Cerro de la Cruz.

### AZTEC CONSOLIDATED MINING CO.

This company issued a prospectus in 1921 covering the promotion of development work and the operation of 37 mining claims totaling 242 "pertenencias" (1 pertenencia = 1 hectare = 2.47 acres), the various claims being located in the region east of Noria station on the railway north of Hermosillo. "La Cobriza" camp is located 16 miles by wagon road from Noria. In addition to the 37 mining properties covered by the claims mentioned, the company also has three consolidated properties which it has taken over for development purposes under contract.

### VERDE GRANDE MINE.

The revolutions in Mexico stopped work on the Verde Grande copper property, which is located about 40 miles northwest of Hermosillo. It is one of the most promising of the recently developed mines in Sonora, and has great bodies of copper ore, carrying gold and silver values, blocked out and ready to ship. Recently arrangements were being made to renew operation of this mine.

### BACOACHILLA MINES.

In February, 1922, it was announced that the San Diego Mining Co., operating in Mexico under the name of the Compañía Minera de San Diego, had been organized to take over and operate the Bacoachilla mines, located on the river of the same name, south of Boludo, in the Altar district, and also the Nido mines in the same vicinity. The Bacoachilla mines were worked by the colonial miners, who were stopped at the water level for lack of adequate pumping machinery. The ore carries gold and silver. Plans of the new company call for the sinking of a double-compartment shaft to a depth under the old workings and the erection of a quartz mill. The Nidos mine is a new discovery on which prospecting work has exposed some high-grade silver ore.

### ROSALES MINES, MOCTEZUMA REGION.

New American capital was also interested in the early part of 1922 in the development of the old Rosales mine in the Moctezuma district, work having been begun on an autotruck road between the mine and the railway at Nacozari. The property is stated to have large ore bodies of copper, carrying gold and silver values.

### EL TRAMADO MINES.

This group adjoins the old Socorro mines of "antigua" fame, located about 20 miles east of Poza, and a road for autotrucks has been constructed to the railway. General Calles, Mexican Minister of the Interior, and his associates, Generals Torres and Piña, have recently spent $200,000 in improvements, consisting of concentrating plant and flotation process, on this property, which is said to have large bodies of good milling value silver ore, with rich pockets of shipping ores. American Alaska mining capital is reported to be interested in this property, together with other mines which have already been taken over in the San Miguel River district 30 miles east of Carbo.

The mines taken over for further development in this latter region include the Santo Domingo, Cargadero, Cerro Verde, La Luisa, and Teresa mines, belonging to various owners and constituting a group of gold claims that have been producers in the past.

### MEJIA MINE, ALTAR DISTRICT.

Late in 1921 new milling equipment was being installed at this property, which is reported rich in silver, the ores running between 20 and 180 ounces per ton in silver. The property is located in the extreme northern portion of the Altar district.

### ALAMOS DISTRICT.

Late in 1921 the Cosden Co., of New York, was engaged in starting the development of a gold-silver property east of Alamos, near the Chihuahua State line, and was also interested in El Caiman mine north of San Blas. This is an old mine that has long lain idle and must be unwatered. It is a silver property.

### LAS CHISPAS MINES.

This property is located about 18 miles south of Cananea, but is usually reached by taking the Douglas-Nacozari Railway to the trail point on this line. The Pedrazzini Mines Co. has taken about $30,000,000 out of this pockety lode during the last 20 years and is now working about 150 men, 65 of whom are in the mine. While some very rich pockets have been encountered, operations have been variously interrupted by revolutionary conditions from time to time, and work has been suspended for years. The mine is now down to the 900-foot level. Twelve per cent of the total gross output goes into dividends. The company is an Arizona corporation, with an authorized capital of $1,250,000, but the company's main office is in San Francisco. Although a series of pockets, the vein has never been entirely lost, although it has narrowed at times to the thickness of a knife blade. The principal values are in silver, with a small gold content. Nevada people own the Chispas extension, but have abandoned the property, from all accounts, at a depth of 175 feet in the new shaft. At the north end the vein is very shattered and low grade.

Plans were being made early in 1922 to begin work on the Espiritu Santo and Ventura mines at the other end of the Chispas vein, where test pits found high-grade ore running up to $1,000 per ton in an 8-inch width of vein. The old Maria mine shaft, down 500 feet, is in this group, but has been full of water for the last 10 years. It is hoped to drain this shaft and use it by crosscutting from the new openings.

### CALUMET & SONORA OF CANANEA MINING CO., S. A.

This company is a subsidiary of the Carnegie Lead & Zinc Co., of Pittsburgh, Pa., which owns all the stock. The company has more than a million dollars invested in lead and zinc ore properties in the vicinity of Cananea, Sonora, and is producing lead and zinc concentrates. It has never been able to pay a dividend and is now seeking a market for its product in Europe, as it is feared that the new American tariff will make importation into the United States impossible.

## NACOZARI MINING NOTES.

In December, 1922, the San Jose mine, near Nacozari, was remodeled and put into operation, treating about 15 tons of ore per day as an experimental test by flotation, promising results having been obtained with an extraction of 85 per cent of the silver values and 90 per cent of the gold values. The ores of the San Jose and Churunababi districts have not been treated successfully to date, and the success of this experiment with the flotation process will greatly increase industry in this section.

The Campo Colorado mine, 17 miles northwest of Nacozari, is having a 10-ton flotation mill installed. This mine was opened in the seventies and some high-grade surface ore taken out, but no way was found then to treat the vein matter lower down.

The old "Pittsburgh" and Guadalupe del Oro mines have been relocated and a 10-ton cyanide plant is being erected at the junction of the Cebolla and Tarrasca canyons near the old El Globo camp.

The opening of the Cananea mines in August, 1922, presaged a general resumption of mining activity in Sonora and Sinaloa; work was resumed on properties abandoned during the years of revolution, new properties were being examined by engineers, options were being taken, and plans were going forward for development and new machinery installations. A score of both old and new mines were taken over by new capital in Sonora, and several mining deals were reported from Sinaloa and Nayarit.

Returns of exports of metals from Sonora to the United States by the end of June, 1922, showed enormously increasing production in mining, and this increase has continued steadily during the last half of the year.

The colonial miners had the great advantage of very cheap labor. These old miners secured the cream of the surface mines and rich ore deposits and even succeeded, in many cases, in profitably working low-grade silver ore deposits and mines that can not be worked to-day at a profit with modern machinery and chemical methods. Since the eighties Americans have been very successful in Sonora in developing copper properties to which the colonial miners paid no attention because the metal had for them little commercial value in their day, and also in reopening old properties rich in good ore which the colonials had been forced to abandon because the water level had been reached. Modern methods and machinery have also made the working of low-grade ores commercially practicable in many cases. Rich strikes have been made since the eighties in old mines that have been pumped out, or in rich pockets found in the old veins worked by the colonial miners. Still new properties are being rediscovered, the ores being too rebellious for the crude methods of the Spaniards or of too low grade to permit of their being worked in colonial times. There are many opportunities for the mining man in Sonora and Sinaloa. In Sinaloa, however, field conditions of transportation are even more difficult, the State does not offer such a wide range of mineralized formations as Sonora, and the old camps are fewer, showing that during colonial times there was not so much mining activity in Sinaloa and Nayarit as there was in Sonora.

### LLUVIA DE ORO MINE.

The discovery of the Lluvia de Oro mine by Americans in 1905 constituted the greatest bonanza in the modern history of the country. The property is located in the Alamos district, partly in Sinaloa and partly in Chihuahua. A large stamp mill and cyanide plant was erected at great expense, and very handsome profits were realized for years. Recent operations have opened up ore chambers estimated to contain $2,000,000 worth of free-milling gold ore of very good grade and even run.

### BATOPILAS MINE.

This is one of the old and steady producing mines of the western watershed of the Sierra Madres, having been operated continuously since the seventies by Governor Shepard. It is located on the Batopilas River in Chihuahua north of the old mining town of Morelos, the outlet being via Choix to San Blas and Topolobampo. The property is a rich silver mine, the ore carrying a high percentage of gold. It was an everyday occurrence to have several of the stamp shoes in the mill clog with native silver yellow with gold, and force the stamp to be thrown out of gear on the cam until the mass of pure metal could be cut away with a cold chisel. (The writer has personally been at this property and seen this happen.) The mine was closed down more or less continuously during the last years of revolution in Mexico, but has been reopened.

To the south of Batopilas—a long, hard day's ride through a rough, mountain country cut by many deep arroyos and canyons—is the old mining town of Morelos, once a famous silver and gold camp of early Mexican Republic days, but fallen into decay since 1900. The ores in this district were roasted with salt and then amalgamated by the "patio" process. In the mountains southeast of Morelos are some gold prospects, and there was formerly a two-stamp mill at La Dura mine in the Duraznos Canyon, below San Jose del Oro. Chinipas is another "antigua" camp of early republic days, long since "dead" so far as active mining is concerned. Guadalupe y Calvo, Los Taros, and many other scattered and less important gold camps, are in the high mountain region of the western watershed of the main range.

At Choix, just south of Fuerte, in northern Sinaloa, the El Fuerte Mining & Smelting Co. has recently completed a 125-ton smelter and has a four or five years' run of copper ore blocked out, running about $1.50 per ton in gold and from 5 to 10 ounces in silver. The plant is employing 40 men at present.

The famous gold mine known as Copalquin (belonging to the Remedios de la Rocha family, and located in Sinaloa three days' hard ride north by east of Culiacan), which has produced a great fortune in free-milling gold, is now closed down. Millions have been offered for this property, but it was never sold by its owners.

Farther south and to the east, a ride of a day and a half from Culiacan, a Boston company, a subsidiary of one of the great American mining companies, installed in 1907 a great reduction and electric plant at San Fernando, the property being a low-grade copper, silver, and gold ledge of enormous proportions. The investment totaled several millions of dollars but was scrapped after a little over

a year of operation because the average value of the ores was too low to pay a margin of profit. The present owner of the mine claims that the real ore chute was never opened by the company, and small operations are at present producing returns.

San Jose de Gracia produced a fortune for the Tariba family, of Culiacan, but is now said to be worked out. This mine is located in the northeastern part of Sinaloa and is where free gold was found in black porphyry.

Pocket miners still continue to work the small, heavily oxidized silver veins in and around Santiago de los Caballeros, two days' ride north of Culiacan, in the Badiraguato district—reducing the ore in small brick furnaces. Americans have prospected this region for years, but have never found a vein that would warrant the erection of a plant. The peculiarity of the Caballeros district is that the ores run into a rebellious arsenical combination below the water line.

On the Sinaloa River the Bacubirito Sinaloa Gold Placers (Inc.), capitalized at $1,000,000 United States currency, has a concession from the Mexican Government to dredge large areas on the Sinaloa River near Bacubirito, on the tributaries called Encinitos and Descubridora, and in the Campo Santo Arroyo.. The company proposes to install a close-connected bucket dredge of 7 cubic feet capacity. The president of this company is Gen. Ramón F. Iturbe, formerly active Madero leader and Governor of Sinaloa for a season.

In the Mocorito district the Palmarito Leasing Co., of Philadelphia, has a promising property in operation, containing low-grade silver ores and equipped with a cyanide plant, grinding being with stamps and rolls.

Work is now active again on El Potrero property, located within 2 miles of the Palmarito mine. This is a gold and silver ledge which has been previously worked from time to time.

The only recent new discovery in Sinaloa is the Mautal mine, a day's ride northeast of Culiacan, equipped with a 10-stamp mill and a cyanide plant, the ledge carrying gold and silver.

In the Mazatlan district the famous old Rosario mine of Bradbury fame has produced $115,000,000 in silver in the 90 years of its operation. The mine is known as El Tajo and has been worked steadily during the last 10 years of revolution in Mexico. It is only 40 miles by rail from Mazatlan and very near to the railway. Offices are maintained in Mazatlan, where the owner also operates the recently completed Hotel Belmar, the finest and most modern hotel on the entire West Coast of Mexico.

The famous old Guadalupe de los Reyes mine, which is just east of Cosala on the headwaters of the San Lorenzo River, and which has produced a great fortune for its Spanish owners in Mazatlan, is still in operation, but on a much reduced scale on account of the shortage of high-grade ores. It has been reported that the Rosario "El Tajo" company has taken over this mine for further development, having acquired a controlling interest recently. Another mine has been opened by Montana interests near Cosala.

The El Tigre mine, a free-milling gold property located 22 miles northeast of Acaponeta in Nayarit, has been opened by an American company (United Eastern Mining Co.) and a mill installed.

The old El Arco mine, which is located near Panuco, east of Mazatlan, and which can be reached in an automobile from the seaport, is

equipped with a mill and is being actively operated at the present time. The mine is a silver vein carrying a small gold value.

## MINING IN MAZATLAN DISTRICT.

There is reproduced below a general report on the mining industry of the Mazatlan district in 1921, submitted by the American Consul at Mazatlan, Sinaloa, under date of January 3, 1922:

The only minerals receiving much attention in this district are gold and silver. There are copper, lead, zinc, but these are regarded as base metals, to be considered only as they occur in ores carrying gold and silver for refining in the smelters of the United States.

The following table shows the quantities and values of mineral products shipped to the United States during the years 1920 and 1921, according to certified consular invoices (but the table does not show accurately the figures of actual shipments, as a few small mine operators in the northern part of Sinaloa secure their consular invoices at the entry port of Nogales):

| Metals. | 1920 | | 1921 | |
|---|---|---|---|---|
| | Quantity. | Value. | Quantity. | Value. |
| Copper.....pounds.. | 41,228 | $9,091 | 21,095 | $2,453 |
| Gold.....ounces.. | 40,350 | 845,921 | 50,139 | 985,645 |
| Lead.....pounds.. | 94,953 | 5,418 | 28,777 | 865 |
| Silver.....ounces.. | 2,489,344 | 2,554,223 | 2,380,362 | 1,492,681 |
| Zinc.....pounds.. | ..... | ..... | 10,281 | 242 |
| Total..... | ..... | 3,414,653 | ..... | 2,481,886 |

The present tendency in the mining industry in this district is toward improvement in mining methods, preparations for more extensive development work on mines that have been previously worked with success, and toward the location and development of new properties.

In general, it may be said that the district has been visited recently by a large number of capable American mining engineers, representing competent mining people and interests, for the purpose of studying the field. It is thought that there is an excellent prospect for the discovery of more rich gold and silver deposits, and it appears that the States of Sinaloa and Nayarit have not been well explored and prospected from the standpoint of mining engineers, in the modern sense of the word.

One of the main factors affecting the mining industry as a whole in this district is the unsettled state of the Federal laws and decrees affecting the production and exportation of metals and mineral products. There have been many changes in the taxes imposed and restrictions in exportation, as well as regulations relating to the location, "denouncement," and operation of mining claims. One of these restrictions is that, for all the gold and silver bullion shipped out of the country there must be an equal value of gold coin imported; and lately the mines have been required to file bonds guaranteeing to the Government that this requirement will be met in the fullest detail. Local taxes and export duties on gold and silver bullion exported average about 11 per cent of the value.

Another matter seriously affecting mining has been the high Mexican import duty levied on explosives for mining purposes. That, it appears, was a matter of customs policy for the protection of the powder factory which it was proposed to establish at Torreon. It seems, however, that during the revolutionary period through which the country has passed, this factory did not operate and the duty was temporarily reduced, but there is renewed agitation for high import duties on explosives to protect the domestic industry, which does not appear to be coming to a position to meet the demands of mine operators for explosives.[19b]

The main economic factor affecting mines in this district in recent years has been the low price of silver. Mines running a low gold content in their silver ores have been able to keep their properties in operation, but silver mines have had to shut down altogether.

[19b] "Dynamite, powder for mines, etc., and other explosives not specified, 0.12 peso per gross kilo" (Mexican tariff). In 1916 a decree reduced the duty on dynamite to 0.04 peso per gross kilo.

A favorable condition is that low wages are again being paid in this district, and the almost total absence of labor strikes has further helped to continue the industry. Occasionally labor agitation does bring difficulties and some danger, especially to foreigners (Americans) whose services are required for the technical and mechanical operation of the properties.

Mine supplies and equipment have had to be imported from the United States at heavy costs for import duties and transportation. Some of the best mines are located in remote mountain regions where the only means of transportation is by pack mule, often taking from three to four days from rail point to destination.

Since the Madero revolt in 1911 there have been only a few significant mining developments in this district, beyond the regular operation of mines that were active properties at that time. Most of the working mines were shut down on account of revolutionary conditions following 1911 and have received renewed attention only since 1919; only one of these properties in this district appears to be in the hands of interests strong enough to carry out extensive development work in new ground.

It would appear, however, that a number of large American mining companies are only awaiting the better assurance of protection and peaceful conditions in the country to enter upon the development of a number of likely mine prospects located at widely scattered points in Sinaloa and Nayarit, and also in northern Jalisco.

A number of native miners have continued to locate prospects which they endeavor to dispose of to Americans. Few of the natives have the necessary funds or technical ability to develop mining properties on a large scale.

All the mines in operation in Sinaloa and Nayarit produce gold in greater or less proportion. In all cases of the largest and best mines, silver is found with the gold in the ores extracted, the mines having been heavily oxidized silver mines on the surface, with the gold values increasing with the depth of the veins.

[NOTE.—The best mines in Sinaloa have been those found on true contacts—a blue diorite and black hard porphyry, with a talc parting on the hanging wall of the diorite.]

Copper is found at various points in Sinaloa and Nayarit, but the northern part of the State of Sinaloa seems to offer the best copper prospects, although little attention has been paid to this metal heretofore by mining men on account of the mountainous nature of the mining districts and the difficulties of transportation, making the commercial operation of copper mines impractical.

All the silver-gold mines carry a lead content in the galena form. In the northern half of Sinaloa there are several known large veins carrying a high lead content with a small silver value. The existing lack of rail transportation makes the development of lead properties impractical at the present time.

### SAN DIMAS DISTRICT.

Two producing properties are found in the San Dimas district—the San Luis and the Candelaria y Anexas, or the Contra Estaca-Candelaria group, the latter belonging to the Col. Dan Burns interests identified with the Rossiter-Crocker interests, of San Francisco, and the former belonging to the San Luis Mining Co. (see reference to development of new hydroelectric plant in San Dimas region, p. 172). The San Dimas mines have a long record of silver production, the metal carrying a fair gold value. Another property has been recently taken over by American interests near Rosario.

### MINING IN NAYARIT.

In May, 1922, a Japanese located Los Tejones mine, 20 miles from the railway station of Yago on the Southern Pacific of Mexico, in Nayarit, and imported three carloads of drilling machinery and air-compressor equipment with which to start active development work. The vein is said to have a uniform width of 32 feet and to carry fair silver and gold values. The present extraction of ore is reported as being from 25 to 30 tons per day.

The State of Nayarit has also had its great old mines of colonial fame. The principal known deposits of silver ores are those of Huicicila and of Espiritu Santo in the municipality of Compostela, both of which were celebrated bonanza producers in the days of the

Spanish colony and made possible the splendor of the famous Spanish line of the Counts of Miravalles. The Huicicila mines are now being operated by Americans, there being on the property a small smelting plant having a 25-ton capacity.

Other old silver camps of Nayarit are those of Acuitapilco, near Santa Maria del Oro; Coapilla and Buenos Aires, near Jala; Casados, La Castellana, etc., in the region of Ixtlan and La Yesca. In the regions of Acaponeta and Huajicori there are also mineral deposits, among them being the Minitas mine (operated for some years by Canadians, who fortified it with a concrete blockhouse and wire entanglements during the revolutions, as it is seen from the railway, which passes within a quarter of a mile of the mine), El Tigre, Cucharas, etc., the last-named mine being owned by the Lacey Syndicate, of Los Angeles, Calif., but at present shut down. The ore is a copper base carrying a gold value. In this neighborhood placers were discovered in 1914 and caused no little excitement on the West Coast at that time. There are also the old silver mines of La Purisima, Zopilote, Mojocuautla, Huanamota, El Frontal, Motaje, Teacapan, Tatepusco, Zapitan, etc.—all closed for many years.

With the exception of the El Tigre, Huicicila, and Minitas mines, the only mine in operation in the State of Nayarit is the group located at Barranca del Oro near Ahuacatlan (four hours' ride to the south of Ahuacatlan). This group consists of two gold-bearing veins, one silver vein, and a group of about 50 small gold veins. The property is equipped with a three-stamp mill and one Lane ball mill for grinding, and also has a small concentrating plant and flotation process. Amalgamation is used. The capacity of the plant is 25 tons of ore per day.

In this same neighborhood is the Molinete Canyon group of veins for which a new 10-stamp mill was installed in 1922 by Americans. This property is now under option to the Hamilton interests of Douglas and Nacozari, and is reported to have great promise.

There is a large area of practically unexplored country lying in the northeastern part of Nayarit, in the Berberia Mountains, inhabited by the Toniti or Nayarit Indians, who resisted Spanish conquest until 1722 and have since then maintained their isolation in these mountains. These Indians are known to possess gold, often trading large pieces with quartz embedded, as well as alluvial nuggets. From time to time small expeditions into this country have met with disaster on account of the warlike character of this tribe.

During 1922 American mining interests of Arizona and Sonora were taking a great deal of interest in Nayarit and had several competent engineers in that field looking up likely properties, after months of travel and work in Sinaloa had failed to reveal anything worth while. The Ixtlan country leads back into the Hostotipaquillo region of Jalisco, a rich mining region worked for many years by Americans. Nayarit is, in general, of volcanic formation, and, as a rule, the known mines have run into difficult ores at certain depths under the heavily oxidized surface formations.

Mine owners in Nayarit are named below:

James E. Lacey, Acaponeta.
Tomas Firman y Socios, Acaponeta.
Juan Clare y Socios, Acaponeta.
Cía. Aguapan y Anexas, Tepic.

Perez Gomez y Castañeda, Tepic.
Ruperto Ambriz, Tepic.
Fritz G. Kaiser, Compostela.
Luis C. Herrera, Acaponeta.
Cía. "El Refugio," La Uesca.
Cía. Concepcion de Gonzalez y Rubio, Ixtlan.
Roberto R. Landrum, Ixtlan.
Estate of Juan Preciado, Santa Maria del Oro.
Cía. Japonesa "Los Tejones," Santiago Ixquintla, in Yago district.

## IRON DEPOSITS.

There are known deposits of hematite iron in the States of Durango, Sinaloa, Aguascalientes, Lower California, Guerrero, Hidalgo, Jalisco, Morelos, Nayarit, Nuevo Leon, Oaxaca, Puebla, Queretero, Sonora, Vera Cruz, Zacatecas, and Colima. The best-known iron-ore deposits on the West Coast are those in Lower California, near Ensenada on the Pacific side, and the deposit 40 miles east of Culiacan, from which iron ore for flux was packed to the Bismuth King mine in the Chacala district. Workable deposits also occur in Sonora but have never been developed. The famous Cerro del Mercado deposit at Durango City contains some 300,000,000 tons of very pure iron ore. The most developed mines are those in Coahuila, supplying the foundry at Monterey. Foundries are also operated in Hidalgo and Jalisco.

There has been some rumor of the utilization of the Lower California deposit for a steel mill to be located at Los Angeles (San Pedro), Calif.

## GYPSUM DEPOSITS.

Deposits of gypsum are found in all Mexican States. In the West Coast territory deposits occur in the districts of Santa Rosalia, Mulege, Gulf of Cortez, island of San Marcos, San Marcos hacienda, and at Ojo de Liebre on the Pacific side of Lower California, south of Ensenada.

In Nayarit there are deposits at the Bolas mine near Amatlan de Canas. In Sinaloa deposits are known at Guadalupe de los Reyes in the Cosala district and at the Cerro de Tepuche, near Quitatan.

In Sonora there are deposits of this material at Aguascalientes, between Guasabes and Operto in the Moctezuma district. The alabaster variety also occurs in the central district of Lower California.

## MICA DEPOSITS.

Sonora usually exports from 40 to 50 carloads of mica to the United States per annum, but high freight rates and low prices at present have curtailed recent shipments.

## ANTIMONY DEPOSITS.

There are 11 known deposits of antimony in the State of Sonora, while in the State of San Luis Potosi a total of 672 claims had been "denounced" up to July 1, 1921, according to the Government records. Deposits of this mineral are also found in a number of other Mexican states, chiefly in Zacatecas, Queretero, and Oaxaca. The amounts exported are not shown.

## METAL EXPORT REGULATIONS.

For some time past the Mexican Government has required a guaranty of the return into the country of an equal amount of gold or silver coin for the bullion exported. The Government maintains a general assay agency at Nogales, Sonora, and requires a deposit in money or bond to cover the value of all bullion or shipping ore sent to the refineries of the United States from Mexican territory. These assay values are afterwards rectified by means of the smelter or mint returns of the shipments. Many small producers are not financially able to make this deposit in cash, or to obtain adequate bonding facilities at the border; there are many such small mines in Sonora and a few in Sinaloa.

## MINING LAWS AND TAXATION NOTES.

On February 1, 1922, the Department of Hacienda (Treasury) ordered canceled 33 mining titles in Sonora alone for nonpayment of taxes in accordance with the provisions of the executive decree of August 28, 1920. In 1922 the decree of March 1 remitted all back taxes unpaid on mining claims in the Republic, on condition that the title holders would pay the three "tercios" (taxes on mines in Mexico are paid in four-month periods) of 1921 and the first two tercios of 1922, payment to be made to the Government prior to September 1, 1922. This new decree enabled a great number of mine owners to redeem their claims on which payment of taxes had been long delinquent on account of the disturbed conditions prevailing in the country for more than 10 years.

## MINING TAXES.

Mining taxes are collected by the Federal Government through the "stamp collector" ("administración principal del timbre"), being payable in net cash three times a year, on the first legal days of January, May, and September. The rates per annum in Mexican pesos are shown below (1 pertenencia = 2.47 acres):

| Pertenencias. | Pesos. |
|---|---|
| 1 to 5 | 6 each |
| 6 to 50 | 9 each |
| 51 to 100 (or more) | 12 each |

## COSTS OF LOCATION OF CLAIMS.

The following are the necessary expenses in connection with the location of claims:

Deposit at "stamp collector's" office for titles, at the rate of 10 pesos per "pertenencia."

Surveyor's fees, according to the nature of the trip to property, time employed, size of the claims taken, etc.

Cost of erection of monuments, which have to be made of stone and mortar, or of concrete, and so placed that from one point two are always visible on either side.

The cost of title issuance at Mexico City is only from 10 to 15 pesos for map attached to the patent covering the claim, and 0.50 peso in stamps.

Mine taxes are payable from the date of issuance of title (patent) and are considered delinquent by the Government the moment taxes are due and unpaid. There is no fixed rule for the Government to declare claims canceled ("caduco," forfeited), except that new

locators can file on the same property and petition its location ("denuncio") from the Department of Hacienda (Treasury) through the nearest mining agent (agente de mineria) if taxes have not been paid promptly. During the past year many owners of mines in Mexico have paid long-overdue taxes to the Government, some of the payments covering taxes for a period of five to seven years. Also, during the various revolutions, many mine owners have been driven away from their properties or have had to leave the country, old records have been destroyed or lost, and a great number of mines have been relocated by persons knowing or learning of their production records or their value. Confusion and litigation have, of course, resulted from these conditions.

## INVESTMENT IN MINING AND OTHER INDUSTRIES.

According to a survey covering the States of Sinaloa and Nayarit in 1918, the total investment in these two West Coast States by foreigners, other than Americans, was as follows:

| | U. S. currency. |
|---|---|
| Spanish: Commercial houses, factories, and mines | $5,000,000 |
| German: Commercial houses and factories | 2,000,000 |
| French: Commercial houses | 300,000 |
| British: Mines, lands, and public utilities | 750,000 |

A conservative estimate of the amount of American capital invested in lands and agricultural development in the States of Sinaloa and Nayarit places the total at $11,495,000 United States currency in 1918. Since then several million dollars more have been invested in winter tomato and vegetable planting for the American market.

From time to time great sums in small allotments have been spent in Sinaloa, Nayarit, and Sonora by Americans in prospecting and development work in mining. The territory is full of abandoned mines and prospects where the operators have either failed to develop good commercial ore or have not had sufficient capital to develop their properties properly, or where ill-advised efforts have been made. There is no means of ascertaining the total investment along these lines, but it must be very great—about as much, in fact, as the total investment in all the present well-known producing mines of Sinaloa and Nayarit. In the following statement there is given an approximate estimate of the investment in the various better-known properties owned and operated by Americans in Sinaloa and Nayarit:

| | |
|---|---|
| Lluvia de Oro Gold Mining Co. | $2,500,000 |
| Mexican Candelaria Mining Co. | 2,000,000 |
| San Luis Mining Co. (San Dimas) | 1,500,000 |
| El Arco Mining Co. (Panuco, Sinaloa) | 500,000 |
| Minas del Tajo (Rosario-Bradbury interest) | 1,000,000 |
| Palmarito mines | 1,000,000 |
| San José de Gracia mines (Tariba) | 1,000,000 |
| Potrero Mining Co. (Mocorito) | 600,000 |
| Cucharas mines (Nayarit) | 500,000 |
| United Eastern Co. (Huicila mines) | 500,000 |
| Choix Consolidated Copper Co. (El Fuerte Smelter Co.) | 300,000 |
| Contra Estaca Mining Co. (Burns interests) | 300,000 |
| Butters Copla mines | 250,000 |
| El Cambio Gold Mining Co. | 250,000 |
| San Vicente Mining Co. (San Dimas) | 200,000 |
| Metates Mining Co. | 150,000 |
| Beveridge interests | 100,000 |
| Howard & Co. | 100,000 |

| | |
|---|---|
| Mitchell interests | $100,000 |
| Nuestra Señora mines | 100,000 |
| El Tigre mines | 100,000 |
| Cajon mines | 75,000 |
| C. Butterfield & P. Francis (Rosario) | 40,000 |
| Clark interests | 40,000 |
| Barretero mines | 20,000 |
| Cía. Minera de Rosa Morada (Nayarit) | 20,000 |
| Las Estrellas | 15,000 |
| San Fernando Mining Co. (San Fernando) (closed) | 2,000,000 |
| Total | 15,260,000 |

In addition to the above list, there should be included many more plants and more or less developed mines, such as those of the Bismuth King, Chacala, of the Amazon Gold Co.; the Dulces Nombres property in the Badiraguato region; the Azteca property in northern Sinaloa, where some $6,000,000 was spent, and many others, which would bring the above total to double, or more, the present showing, which includes only properties now active.

In commercial enterprises and factories the American investment on the West Coast is extremely small, totaling only about $387,500, United States currency.

There is no investment in banking other than the American capital interested in the reorganization of the Banco de Sonora (see p. 255).

## ORE BUYING IN MEXICO; CUSTOMS AND USAGES.

Conditions have been so chaotic in Mexico that even at the present time it is difficult to furnish a concrete statement on ore buying that would not be subject to more or less criticism or change in the near future. In general, it may be said that the customs and usages in ore and metal buying in Mexico vary little from those in the United States on account of the fact that, of the important smelting and refining plants in Mexico, five are owned or controlled by the American Smelting & Refining Co. and five others by the Compañía de Minerales y Metales (American Metal Co.), and American methods have prevailed to the almost entire exclusion of the old customs of the country—only a trace of the old weights and measures being found, perhaps, in some out-of-the-way place. General methods and conditions of payments, deductions, treatment charges, and other details are the same as in the United States, with the exception that the units of weight and measure are different; the metric system is compulsory in Mexico, ores being bought by the metric ton and assays given in kilos of silver per ton and grams of gold per ton. Federal production taxes are based on the kilo for precious metals, and, therefore, assays for the Government are reported in that unit or the fractions thereof, but, for gold, commercial practice has found the use of the gram per ton more convenient. Conversion from one system of assay to the other is a simple matter, depending on the fact that there are 29,166 troy ounces per ton avoirdupois, and therefore 1 kilo of silver per ton of 1,000 kilos equals 32,150 troy ounces, there being 32,150 troy ounces in a metric ton.

Taxes on the metal production in Mexico are now fixed by the decree of June 29, 1919, which prescribes a Federal production tax of 8 per cent of the gross value on all gold and silver exported in the form of ores, or in any form except bullion, and 7 per cent on the

gold and silver exported as base bullion, or presented to the mint for its coinage. The various States are also authorized to levy an additional tax of 2 per cent of the gross value as an extraction, or ground, tax. At the same time a tax of 1 per cent was imposed on zinc, tin, and some other metals, 3 per cent on lead and from nothing up to 6 per cent on copper, with authorization to the States to levy an additional tax equal to 50 per cent of the Federal tax, up to 2 per cent of the total gross value. The Federal tax is really a production tax but is levied in the form of an export and coinage tax.

The great copper mines of Sonora shut down on December 15, 1919, because of labor troubles and the slump in the copper market following the war-time demand for this metal. On January 12, 1921, the Mexican Government decreed the removal of the export duty on copper when the market value should fall below $0.15 per pound for electrolytic copper in New York, the remission of export tax being effective as from December 25, 1920. This action was followed by heavy exportations of stocks on hand from Nacozari, Cananea, and Santa Rosalia, which only had the effect of further depreciating the market, which fell to below $0.03 per pound for a short time.

The State tax on mineral production is collected through the local tax collector's office directly as an extraction tax from the producer, but to enforce payment, everyone concerned in handling the metal or the ore is made responsible and liable for the tax payment in the event that it is not paid by the producer. Inasmuch as the amount depends upon the assay value and as this is not accurately determined until the ore is sampled, assayed, and sold, the practical result is to make the smelters and ore buyers collectors of the tax, and they, in turn, pay it directly into the Government offices.

This system worked very well until the Government made the compensation of the district tax collectors dependent upon the district collections. Then the natural result was that the miners were not permitted to ship ore out of the district until taxes had been paid, but, as the amount of the taxes depended upon the value of the refinery returns, neither the collector nor the shipper knew what they should be. This has resulted in considerable confusion.

On the first of every month the Department of Hacienda (Treasury) issues a table of metal prices which are to be used in computing the tax during the succeeding month. Gold is, of course, at a fixed rate of 1,333.33 pesos per kilo. The prices for the other metals are calculated from the market returns received during the preceding month. The States, however, often adopt for copper and lead an arbitrary value that remains fixed for an indefinite and considerable period.

The Mexican law requires that the seller shall furnish the buyer with a duly stamped invoice, called a "factura," for every lot sold, default of which renders both parties liable to a heavy fine. Merchants and regular shippers or dealers in metals have to carry a set of bound books, the stubs of which must bear the stub part of the required revenue stamp showing the transaction.[10]

[10] For a list of custom smelters and ore refineries in Mexico, the reader is referred to an article on "Ore Buying in Mexico," in the Engineering and Mining Journal for March 20, 1920.

## BANKS AND BANKING.

Prior to the last revolutionary period in Mexico all the old-line national banks of the Republic were well represented on the West Coast, the old Banco Nacional, the Banco de Londres y Mexico, etc., maintaining branches in their own buildings in Mazatlan and Guaymas. The Banco de Sonora, with head offices in Hermosillo, also maintained branches and agencies in the principal towns and cities of the West Coast, and the Banco de Jalisco maintained a branch at Tepic. The Banco Occidental, of Mazatlan, maintained branches in Tepic, Culiacan, and San Blas, Sinaloa.

With the suspension of these Mexican National and State banks during the Carranza régime (they were all banks of issue) and the various financial ills from which the country suffered during the era of fiat paper money, banking on the West Coast was carried on principally by the long-established commercial houses acting practically as private bankers and buying and selling exchange. The old Banco de Sonora, of Hermosillo, was reorganized on the American side at Nogales, Ariz., under the name of the Sonora Bank & Trust Co., and established agencies (practically branches) in Hermosillo, Navojoa, San Blas (Sinaloa), Culiacan, and Mazatlan. Two of the old-line banks also maintained agencies, so called, at Guaymas and Mazatlan.

During the recent revolutionary period in Mexico there has been sufficient capital on the West Coast (consistent with the aggregate purchasing power of the population and with conservative business practice) to finance the commercial transactions of the territory—what with the capital of the old commercial houses, the bank agencies mentioned, and also some private and commercial money—but capital is not available nor sufficient to finance agricultural enterprises or industrial development.

The production of "garbanzos" in the Yaqui and Mayo Valleys has not been disposed of readily at good prices for some years; two years ago this was also true of the rice production of the Yaqui Valley, and it was again true of the 1921 wheat crop in Sonora. The local consumption is not sufficient to take care of the yield each year, the products mentioned can not be shipped into the United States to compete with the American production, and transportation costs prevent their shipment to the interior of Mexico where foodstuffs are badly needed. Also, on account of the provisions of the agrarian law of Mexico which seriously affect land titles, there is no real security for loans made on agricultural property; and, furthermore, on account of the general depression and the aftermath of the revolutionary periods of destruction of the sources of wealth, real property in the towns and cities has also suffered severe depreciation and has no active demand.

Aside from commercial needs, the greatest demand for capital on the West Coast during the past three or four years, and more especially within the last two years, has been for planting winter tomatoes and vegetables for the American market, these being the agricultural products in which the landowners and farmers of the West Coast can realize the best profits and the most ready cash. These capital

needs have been readily supplied by California produce people, their investment in the fall of 1922 being estimated to be about $2,000,000 of new money in this branch of agriculture alone on the West Coast.

Mining is principally financed by the large mining companies having properties both in Arizona and Sonora, with California and Nevada also contributing toward the development of this industry on the West Coast.

Toward the end of 1920, when the commodity market fell heavily to even below pre-war normal prices and values, the sugar-mill people of the West Coast were advised by their American sources of credit that no further advances would be made to them under any circumstances. The sugar industry of the West Coast was left by the boom times and high prices of the war years in a very prosperous condition; old extensions and improvements had been paid for, all old indebtedness wiped out, new planting of cane taken care of, etc. At the close of the war Sinaloa sugar could no longer enter the United States in competition with the Cuban and Hawaiian production, which has preferential tariff advantages, and the only market outlet left to them was the interior of Mexico, while their capital supply was in the United States, warehouse commodity loans from Mexican financial agencies not being practicable in Mexico on account of the still doubtful political situation. As the product had to be shipped around by rail from the West Coast via Nogales and either El Paso or Laredo to reenter Mexico, it was found practical to provide storage depots for sugar, principally at El Paso, and distribute to the Mexican market in the interior according to the demand. Warehouse receipts in El Paso on the American side of the line were collateral for bank loans, and this plan also obviated the necessity of taking risks in overstocking distributing dealers in the interior of Mexico, quick delivery being afforded from the border depots.

The sugar mills were purchasing all equipment and supplies in the United States when their money supply was cut off abruptly in 1920. An American firm with headquarters in Nogales, Ariz., and with many years of experience in supplying the machinery, equipment, and supply needs of the mining industry of Sonora and the West Coast—knowing the West Coast and its people, industries, natural wealth, production, and conditions—saw in the situation of the sugar people an excellent opportunity to increase its machinery and supply business. It advised the sugar producers that it was prepared to take care of their equipment and supply needs on an ample credit arrangement, based on the crop and grinding season, etc., with the result that this firm has had a virtual monopoly of the business with the sugar people in this and allied lines and has cemented a commercial and business relation exceedingly valuable for the future. The firm has considerable capital of its own and also made financial arrangements for the rediscounting of the paper of the sugar people with connections in the United States—principally private capital having confidence in the West Coast and its industries. Rediscounting is only resorted to when the demand for credit is over the capacity of the firm itself, considering the demands of its other activities. The sugar mills' paper is held for six months, or, very often, even for a year, from one crop season to another.

The relations outlined above have proved to be most satisfactory to all concerned and have resulted in an additional interest profit for

the house—its greatest asset thereby acquired being, of course, the friendly relations with the sugar mills, which, aside from the great mining industry, are the heaviest purchasers of machinery, equipment, and supplies.

Such an arrangement is also very satisfactory to the manufacturers of the equipment and supplies needed for the sugar industry, as these run into large sums of money and they always prefer to have an assured source of practically cash payment in the United States.

Following is a list of the banks in the West Coast region:

| Name of bank. | Capital. | Location and agencies. |
|---|---|---|
| | *U. S. currency.* | |
| First National Bank of Nogales, Ariz. | $100,000 | No agencies in Mexico. |
| Nogales National Bank | 50,000 | Do. |
| Sonora Bank & Trust Co. (see Banco de Sonora), Hermosillo, Sonora. | 100,000 | Nogales, Ariz. Agencies at Nogales, Guaymas, and Navojoa, Sonora; Culiacan, Sinaloa. |
| Compañía Bancaria Mercantil y Agricola de Sonora, S. A. | 200,000 | Hermosillo, Sonora. Agency at Nogales, Sonora. |
| Banco de Sonora | 750,000 | Hermosillo, Sonora. Agency at Guaymas, Sonora. |
| Compañía Bancaria Mercantil de Cananea, S. A. | 60,000 | Cananea, Sonora. |
| Banco Nacional de Mexico | ..... | Mexico City. Agencies at Guaymas, Sonora, and Mazatlan, Sinaloa. |
| Compañía Comercial, Bancaria y Marítima de Sonora, S. A. (in liquidation). | ..... | Guaymas, Sonora. |
| Minas "El Tajo" (Bradbury) | ..... | Mazatlan, Sinaloa. |
| Wohler, Bartning, Sucs. (wholesale merchants and private bankers) | ..... | Mazatlan, Sinaloa. Agencies at Culiacan and San Blas, Sinaloa, and Navojoa, Sonora. |
| Echeguren y Cía. (wholesale merchants and private bankers, Spaniards). | ..... | Mazatlan, Sinaloa. Agencies at Acaponeta and San Blas, Nayarit. |
| Melchers, Sucs. (German; wholesale merchants and private bankers). | ..... | Mazatlan, Sinaloa. Agencies at Culiacan, Guamuchil, Mocorito, San Blas, and Villa Union, all in Sinaloa. |
| Delius y Cía. (German; soap factory and private bankers; also coffee planters). | ..... | Tepic, Nayarit. Agency at San Blas, Nayarit. |

The banks and commercial houses listed above do not operate under regular banking charter since the financial troubles affecting banks of Mexico during the Carranza régime, but they do a general exchange business, make collections, and, in general, take care of their customers as private bankers.

The Compañía Comercial, Bancaria y Marítima de Sonora, S. A., was a local financial firm organized by Guaymas capital during the period of revolution to take care of the banking needs of the Guaymas commercial district, which includes the Yaqui and Mayo Valleys. It failed and has been closed since April, 1921. A meeting of the board of directors was called by the liquidators for August 25, 1922, to approve the work of liquidation.

The Comisión Monetaria, financial agency of the Mexican Federal Government, maintains offices at Guaymas, Hermosillo, Nogales, Mazatlan, and Tepic.

All the banks listed as such in the above list buy and sell exchange on Hongkong, China, direct, for the convenience of their Chinese customers who have large commercial interests on the West Coast of Mexico and considerable financial transactions with China—in the exporting of such products as shrimp, shark fins, etc., the importing of rice, etc., and the depositing in China of surplus earnings, it being the ultimate ambition of every Chinese on the West Coast to eventually retire on his earnings and spend the rest of his days in the land of his ancestors.

The Sonora Bank & Trust Co., of Nogales, Ariz., is a subsidiary of the Banco de Sonora, of Hermosillo, and controlled by the same stockholders. It was organized in the United States after the closing of the Mexican national and State banks during the Carranza régime and practically continues the business of the parent organization throughout the West Coast of Mexico in the form of agencies. The banks listed also receive checking deposits and allow 6 per cent interest on time deposits.

Delius y Cía. are an old German firm established in Tepic and owning coffee plantations and a soap factory in Nayarit. This firm practically controls the port of San Blas, owning the only lighters and cargo warehouses there. It carries on a general private banking business and has heavy loans out to the various large landowners of Nayarit. It is the only banking agency in Tepic. Commercial transactions with Tepic are usually handled through houses or banks in Mazatlan, as most shipments of merchandise come down from either Los Angeles or San Francisco by water to Mazatlan and are then reshipped to Tepic by rail over the Southern Pacific of Mexico Railroad.

## CREDITS, TERMS, AND GENERAL BUSINESS PRACTICES.

The usual commercial credit terms allowed on the West Coast of Mexico by American exporters of general merchandise, and also by the wholesaling dealers and importers of Mexico City and Guadalajara, are 60 to 90 days from date of invoice. American jobbers in Arizona and California, shipping to houses in Sonora, usually allow 60 days, with 90 days for the territory from Culiacan south to Tepic. Parcel-post shipments of high-priced goods are sold usually at 30 days from date of invoice. On all credit transactions 2 per cent discount is allowed on all three-day sight payments made by the buyers.

After the close of the war there was a great deal of speculation regarding the ability of European countries, especially Germany, to renew their old commercial relations with the West Coast through the large and long-established German firms of Mazatlan, granting the same credit terms as were common before the war—usually six months. The merchants were also very keen to take advantage of the low European exchanges, but after months had gone by they began to realize that prices for German goods were increasing and that deliveries could not be depended upon. During the war period all of the West Coast trade went to the United States, and commercial relations begun then have since been more and more closely cemented.

American Pacific coast houses were eager to increase their commercial relations with the West Coast and maintained salesmen in the field constantly, resulting in their securing practically a monopoly of the business in drugs, dry goods, and minor lines. A good volume of business was obtained during 1921, but in 1922 Mexico began to feel the effects of the general economic depression from which the country is still suffering; business obtained on the West Coast fell off to a very considerable extent, and collections began to be difficult, except in the cases of orders sold to the larger and long-established houses which have an adequate commercial capital and credit standing. In the summer and early fall of 1922 business was practically stagnant throughout the West Coast and collections were very difficult in the cases of the smaller houses. An improvement in these conditions was looked for in the late fall on account of the influx of tomato and winter-vegetable money and the marketing of the corn, bean, wheat, "garbanzo," and rice crops, and also because of the partial resumption of mining activity, especially in Sonora.

### OVEREXTENSION OF CREDIT.

In many cases jobbing houses of the Pacific coast of the United States—and also in less degree inland firms—have been guilty of the mistake of overextension of credit to small firms in the West Coast territory, and bills of goods have been shipped on 60 and 90 days' time without proper investigation or an adequate credit report. It is a fact that during the years of revolution and political upheaval in Mexico business in general has been greatly disorganized. Many

of the older firms have lost heavily; in some cases their owners or principals have been forced to leave that part of the country after severe loss. Many new and untried people have gone into merchandising, and there have been the failures that might be expected under similar conditions anywhere.

It is also a fact that the large and long-established German and Spanish houses of Mazatlan, Guaymas, etc., have for years been doing a large portion of their buying in the United States; they naturally have their relations well cemented, and a new firm interested in that field finds it difficult to secure even a small proportion of their trade. These old houses of the West Coast have operated in that territory for years and have had a force of salesmen constantly on the road, even in the far interior only reached by mule-back travel, such as Cosala, Chacala, etc. They have a great influence with the small buyers of the interior and also those of their own cities on account of their ability to grant long-term credits—usually six months. It further follows that all the small dealers of the larger cities want to be direct importers and to "wholesale" in the manner of the larger houses, which are in reality importing wholesalers as well as local retailers. American distributers, in their desire for export trade, have committed the error of overestimating the territory's ability to absorb certain lines of merchandise, usually on account of having figured the same per capita consumption in any given line as in their calculations and estimates for the United States, not stopping to realize that anywhere in Latin America the bulk of the population does not possess an annual per capita purchasing power equal to that in the United States and that therefore this market is much more limited than an American market with equal population.

The result has been sales to small importers who were not adequate credit risks, having too little capital or resources, and who were really legitimate purchasers at wholesale from the larger importing houses which are able to finance local and interior long-term credits. American firms that have gone into this field and have exercised ordinary precaution, restricted their transactions to the limitations of the market, and proceeded in accordance with prevailing conditions, have realized good profits and have built up a business for the future that will prove advantageous to them during a time of depression at home.

## PAYMENTS AND COLLECTIONS.

Commercial transactions are handled on the West Coast under the usual system of drafts accepted by the buyer. The Mexican Commercial Code is very strict in its requirements, and ample protection is afforded the seller in the event of nonpayment, at collection and payment dates of drafts accepted by the buyer. However, on account of the distance, legal costs, delays, and the difference in the Latin American laws governing seizure of real and chattel property in satisfaction of debts, etc., it is a case where "an ounce of prevention is worth a pound of cure" every time, and an exporter's best protection is a careful credit and reputation investigation before shipping goods on credit to an unknown firm. There are many flagrant cases where American firms have shipped valuable goods to

parties having no regular established business and possessing no resources or even credit standing in their own communities abroad. Such cases are hopeless, and the blame should rest with the sales and credit departments of the house making the shipment. Inexperienced salesmen also often make the mistake of overselling, especially when meeting keen competition. The advantage always lies with the exporter having a branch office or local representative who is familiar with the territory at first hand.

There are available two reports—from the American consuls at Mazatlan and Guaymas—which cover very thoroughly the subject of the cost and method of protesting drafts. Persons interested in this information should address the Division of Commercial Laws, Bureau of Foreign and Domestic Commerce, Washington, D. C.

Reference may be made to the English translations of the Mexican Civil Code and Commercial Code, both of which contain the legal provisions pertaining to these matters of business transactions in the Republic of Mexico. As had been said, these provisions are definite and clear and afford ample protection to the seller, a defaulting indorser of a draft being unable to escape the penalties imposed by these provisions. The default of payment of an accepted draft in actual practice in Mexico means the immediate loss of all standing and credit for the party involved.

The use of powers of attorney is important in all Latin American countries and is little understood by the average American business man interested in foreign trade. For the benefit of exporters to Mexico, and others, the American consul at Mazatlan, Sinaloa, submitted, under date of August 8, 1922, a report that covered every phase of the issuance of powers of attorney by Americans for use in Mexico as follows:

Forms of power of attorney by sole owner.
Forms of power of attorney executed by a partnership.
Forms of power of attorney executed by a corporation.
Functions to be specified, except in general powers of attorney.
Language requirements in powers of attorney.
Cancellation of powers of attorney.
Form of stating personal appearance in powers of attorney.
Relation to form of power of attorney prepared in the United States.

Persons interested in this information should address the Divison of Commercial Laws, Bureau of Foreign and Domestic Commerce, Washington, D. C.

### TIME REQUIRED FOR SHIPMENTS AND DELIVERIES.

The average time required by an importer in, say, Mazatlan to receive merchandise ordered from the exporters located on the Pacific coast of the United States is 30 days, compared to 60 days from American Atlantic ports of export, and 90 to 120 days from European ports of shipment. Large importing wholesale firms of Mexico City also sell goods to the West Coast, but in decreasing volume since the Great War disrupted Europe's commercial systems to a very great extent. The time in transit from Mexico City to West Coast ports, via rail to Manzanillo and steamer to Mazatlan or Guaymas, is about the same as from San Francisco or Los Angeles, now that the West Coast has a very adequate coastwise steamer service, with competing lines, although freight and handling charges from Mexico City

are greater. The trade with Mexico City was chiefly due to the influence of the German, French, and Spanish houses of the capital, having relations with houses in their respective countries and with nationals established on the West Coast. During the war these houses on the West Coast, in Mexico City, and elsewhere in the country were forced to seek their supplies of merchandise in the United States; the failure of Europe to recover as rapidly as was expected following the war, and the greater suitability of many of the American lines of manufacture have caused most of the trade to continue to go to the United States. This is especially true of the last year and a half, during which Mexico has been going through a period of economic depression, and orders have been more and more limited to the immediate needs of the local markets and their decreased ability to absorb goods—the shorter time of delivery of merchandise from the United States playing a large part in influencing the placing of the business there.

### AVERAGE VALUATIONS TO COVER CHARGES.

There is such a very considerable variation in the import duties levied on the different classes of merchandise that it is not practicable to give definite percentages.

A shipment of piece goods, if all cotton, would cost from 5 to 10 per cent of the invoice value for import duties and about $10 United States currency per ton for freight and handling charges, if shipment were made by water to Mazatlan, for example, including cartage to importer's warehouse or store.

Most heavy hardware and machinery comes in free of import duty. On small hardware and tools the average cost laid down at, say, Mazatlan would be about 25 per cent in excess of the invoice value.

Drugs run about 30 per cent in excess of the invoice value.

### RATIO OF ANNUAL TURNOVER TO CAPITAL AND STOCKS CARRIED.

There appears to be no fixed estimate of the ratio of annual turnover to capital and stocks carried, this being dependent on individual initiative and effort and also on the selection of major lines by the various dealers. As a rule, with fairly small dealers in normal times the gross sales per annum are about double their capital and average amount of stock carried on hand, the largest volume of sales being from December to May—that is, after the annual corn harvest and in anticipation of the new planting. There are, however, cases where an importer will do an annual volume of business totaling $500,000 on a total capital of $75,000 United States currency. There have been recent cases where several partners have established branch stores up and down the West Coast to handle a miscellaneous line of goods, like the well-known 5 and 10 cent stores in the United States, starting out with a total cash capital of possibly $5,000 and rapidly building up their total annual business to very large proportions by their use of credit secured in the United States and their system of small local stocks of readily salable merchandise of wide variety. However, as a rule such small new firms are not good credit risks unless their experience and ability are personally known to the firm selling to them, because many young men in Latin

America go into merchandising in a small way, there being no such opportunities for them in other lines of endeavor as exist in the United States or Europe. On the whole, it may be said that merchandising is, as a general rule, overdone, in view of the rather restricted purchasing power and limited demand of the bulk of the populations in the West Coast commercial districts.

## SELECTION OF ATTORNEYS FOR COLLECTIONS.

In connection with collection matters in Mexico, or any Latin American country, after the usual procedure (through the correspondent bank of the exporter's bank in the United States) has failed to secure the payment of the account, care should be taken in the selection of an attorney to take drastic legal action. It should be borne in mind that in Latin American communities family ties are very strong, relationship means a great deal, and there are strong bonds of friendship, political affiliations, etc., which do not always make it personally pleasant or convenient for a local attorney to push the collection claims of his client in the United States or elsewhere. The local bank is always a good source of information regarding the selection of an attorney for collection work, as its officers know local affiliations and connections well and are themselves experienced in such matters. It is always better to allow a period of installment payments to be made at first, rather than to push a claim from the start. Local merchants suffer from seasonal conditions, such as partial crop failures causing a period of depression, etc., and most of them—if, in the beginning of the account, considered good credit risks—will eventually pay the deferred accounts that they owe to exporters.

## CREDIT PECULIARITIES ON WEST COAST.

There is a very considerable trade rivalry between San Francisco and Los Angeles for the trade of the West Coast of Mexico, and during the past three or four years the large jobbing houses of Los Angeles have made heavy inroads in that territory which, prior to the construction of the Southern Pacific Railroad of Mexico down the coast from Guaymas, was considered as belonging principally to San Francisco, the bulk of the shipments being made by water to Mazatlan and Guaymas. San Francisco also took the bulk of the exports of the West Coast. A number of cases have come to light, during the last year or so of economic depression throughout the West Coast, in which certain unscrupulous buyers in that territory took advantage of this trade rivalry to secure shipments of merchandise without payment, going to dealers in one place after failing to pay their bills at the other. This practice can be stopped by a comparison of ledger experience between the houses engaged in the same line at both places, or by the use of an American credit service which obtains its ratings on foreign buyers from the ledger experience of the various American exporters—a source from which such data should come, and not from the buyer most interested.

The first consideration with regard to credit allowances for the West Coast is the fact that the market is limited by the low population and relatively small per capita purchasing power of the greater number of the inhabitants, and that it is not a wise or wholesome policy

to overextend credit allowances or to take too great risks in an endeavor to increase sales. In other words, the worst mistake the West Coast salesman can make is to "oversell" his customers who like to carry large stocks on hand regardless of the local demand, and will do so (despite the fact that they can get renewals within 30 days from the United States) as long as they can get unlimited credit.

For conditions on the West Coast affecting buying and credits, see the following chapter on "Commerce and trade." [11]

[11] Much very valuable and practical material in relation to Latin American credit practice and experiences has been collected by the division of commercial laws of the Bureau of Foreign and Domestic Commerce, in connection with the commercial-law survey of that territory which this division has been carrying out (questionnaires Nos. 51 and 61).

## COMMERCE OF THE WEST COAST.

The West Coast trade territory covers about one-fifth of the total area of the Republic, or approximately 154,000 square miles, including small portions of the States of Durango and Jalisco. The total population of the three coast States of Sonora, Sinaloa, and Nayarit is 760,000, or only about one-twentieth of the total population of Mexico. As a market this commercial territory is limited by this rather low ratio of inhabitants compared with the area covered, and, as compared with a similar population in the United States, is still further limited as a market for imported goods by the low per capita purchasing power of 80 per cent of this number of people.

The West Coast States of Jalisco, Michoacan, and Colima have an estimated combined population of 2,272,156, or three times the number in the three West Coast States that are the subject of report. Guadalajara is the commercial center of this latter region.

The people of the State of Jalisco have a higher per capita production, and therefore purchasing power, than the people of the States to the north treated in this report. Since convenient and adequate water transportation is now afforded on the West Coast to and from American Pacific coast ports, and is being found to be cheaper than all-rail transportation, it follows that American exporters of the Pacific coast territory of the United States can now develop their trade relations with the Guadalajara commercial territory to advantage, and thereby increase their commercial transactions with the West Coast of Mexico by three times, roughly speaking, although it is to be borne in mind that, as Guadalajara is farther inland and more readily accessible from Mexico City, keener competition will be met in this latter market, emanating from the large importing wholesale houses long established there, which import large quantities of merchandise from both Europe and the United States for distribution in many of the southern and western commercial regions of the country.

However, the three northern West Coast States were formerly commercially tributary to the capital to a very great extent and are now really the commercial territory of California and Arizona. There is no good reason why the American exporters of the Pacific coast of the United States can not, by the employment of the same diligent methods of trade building, also secure their share of the business centering in Guadalajara and work this additional trade territory in connection with their already organized sales activities which cover the three northern West Coast States. The problem resolves itself into a question of proper selection of merchandise, proper sales methods, and the individual initiative and activity of firms in the field.

## DIVISION OF COMMERCIAL REGIONS.

The trade of the eastern Sonora region, which includes the great mining centers of Cananea and Nacozari, goes principally to Douglas, Ariz. The large stores of the mining companies buy directly from manufacturers, wherever possible, and very little from local jobbers and wholesalers. Mining and cattle are the principal industries in this region, with the first named by far the more important. The estimated population of this division is about 36,500.

Nogales (both American and Mexican) gets the commerce of the northern central part of the State, including some of the trade from Cananea, its territory reaching far south into the interior and also west to and including the Altar district. The estimated population of this commercial region is 31,480.

The commercial center of Hermosillo imports direct, and its trade influence covers a wide stretch of sparsely inhabited territory radiating in all directions. The commercial population of this region is estimated to be about 33,100 people.

Next comes the Guaymas commercial center. Guaymas was formerly the second most important port of entry and point of distribution on the West Coast, but since the building of the Southern Pacific Railroad down the coast from there it has fallen very considerably in commercial importance, although it is still headquarters for the trade of the Yaqui and Mayo Valleys, both rich agricultural regions. The estimated commercial population of this trade territory is 56,260, although a large portion of the trade of the Alamos district, containing about 18,000 people, now finds its way to the border or is being secured directly by travelers and traders who obtain their stocks of merchandise from the jobbing houses of Nogales.

The Navojoa region alone contains some 18,000 people, and at least two of the larger importing houses of Mazatlan have branches there and "cut in" heavily on the trade of Guaymas. During recent years the business houses of Guaymas do not seem to be as active as they were formerly, and are suffering from lack of sufficient capital with which to maintain their former prestige. The railway down the coast has allowed the trade to be variously distributed, and the greater capital and activity of the Mazatlan houses has heavily curtailed the business of Guaymas.

The next important trade center down the coast is San Blas, Sinaloa, located at the crossing of the Southern Pacific and Mexico, Kansas City & Orient Railways. San Blas is the trading center of the rich Fuerte Valley, which has a population of 45,530. A few of the houses here import directly, principally from Los Angeles jobbers and wholesalers, but here also are found large branches of two of the Mazatlan importing houses which practically control the trade, carrying much larger stocks than any other commercial agency in the region.

The next commercial center is Sinaloa, head of the Sinaloa River Valley, which has a commercial population estimated at about 43,400. Houses in Sinaloa formerly bought principally in Culiacan, but this is no longer the case since the trade of Culiacan has been disrupted by the discontinuance of the old houses there; Sinaloa now imports directly and also buys from the large importing houses of Mazatlan.

There are a few stores at Bamoa and Mocorito that import directly.

Culiacan controls the trade of a great district which includes Badiraguato, Cosala, Tamazula, and even such isolated towns in the Durango Mountains as Chacala, 105 miles east of Culiacan. However, conditions brought about by the years of revolution have practically wiped out the old houses of Culiacan, which has recently been invaded by branches of the large firms of Mazatlan, which now do the bulk of the business at wholesale. A few of the larger stores import directly, principally from Los Angeles. The trade of Quila (on the San Lorenzo River), El Dorado, and even Cosala now goes principally to Mazatlan over the railway—mainly on account of the lack of sufficient commercial capital and enterprise on the part of what is left of the old houses long established at Culiacan. The commercial population of the Culiacan trade region may be estimated at about 62,350.

Mazatlan has become the largest commercial center of the West Coast, next to Guadalajara in Jalisco, and, besides the incursion of its merchants into northern Sinaloa and even southern Sonora, it controls the rest of the commercial territory of the State of Sinaloa, estimated in population at about 172,000, and, in addition, about one-half of the trade of the neighboring State of Nayarit, or, one may say, an additional commercial population of 80,000.

The old commercial center of Tepic, capital of Nayarit, is in much the same condition as Culiacan. Only two of the old houses remain in active business and import direct, most of the rest of the trade going to Mazatlan as the wholesaling center, although numbers of the small and new traders import in small lots for their own account, chiefly from the United States. Santiago Ixquintla, Acaponeta, and Esquinapa trade in Mazatlan. Tepic enjoys the trade of the southern half of the State and may be said to have a commercial territory of some 60,000 people, although their buying power has been very greatly curtailed during the revolutionary period and the population has diminished through emigration to other places.

## BUYING SEASONS.

In eastern and northern Sonora the chief influence on trade activity is the condition of the mining industry, and the chief factors affecting this industry are political conditions in Mexico and the market prices for copper and silver. When the great camps shut down, thousands of workers in Sonora are forced to emigrate to the United States to gain a living, and trade diminishes in consequence. The wheat crop and market price in the Magdalena Valley just south of Nogales also affect trade conditions of the Nogales and Hermosillo districts. Some years the wheat crop in northern and central Sonora suffers severely from frosts.

Trade conditions of the Hermosillo region are affected by both crop conditions and the activity in the mining industry; and the same may be said of the Guaymas district, which includes the Yaqui and Mayo River Valleys. When the mines are active they sustain demand during the entire year, although trade is more slack in this line during the rainy season (which is during the summer months) on account of the greater difficulties of transportation.

In the agricultural valleys of the coast proper, including such trade centers as Navajoa, San Blas, Sinaloa, Culiacan, etc., very little merchandise moves during the period of the rainy season. Most of the available labor is busy with planting, and pack-mule trains can not move into the interior regions on account of the swollen streams and the condition of the trails.

General buying is most active following the corn and bean harvest in November and December, with the latter the peak month, when there is more money in circulation and advances contracted in April, May, and June for planting are paid off and the surplus is spent in the stores. Again, buying is active along in May and June, when planters are preparing their ground for the season's crop and their men are outfitted for the crop season, as is the custom of the country.

During the past few years the winter tomato and vegetable industry has grown rapidly in nearly all the valleys of the West Coast and employs the greatest number of laborers in November when the plants are set out—the picking, packing, and harvesting lasting from the end of February until the middle of May. This branch of agriculture is attracting several million dollars of new capital to the West Coast and very considerably increasing the demand for general merchandise.

Traveling salesmen usually cover the West Coast from November until May. The work of introducing a new line or of securing connections for a new house in this territory should be started not later than November.

## TAXES ON TRAVELING SALESMEN.

The State of Sonora does not require traveling salesmen to pay a tax, but each municipality (county) makes its own regulations covering this matter.

*Nogales, Sonora.*—In Nogales traveling salesmen must pay one-half of 1 per cent monthly on the value of their sales.

*Cananea.*—Salesmen who take orders do not have to pay a tax in Cananea municipality, but those who have no established business there and who send goods to customers in the Cananea district must pay a municipal tax of 3 per cent of the invoice value of such goods.

*Magdalena.*—The Magdalena subdivision of the State of Sonora places no tax on traveling salesmen.

*Moctezuma.*—Travelers representing foreign houses selling goods in Moctezuma municipality pay a tax of 10 pesos (nominally $5 United States currency) monthly.

*Altar, Sonora.*—The municipality of Altar, in Sonora, requires no tax on traveling salesmen.

*Aguaprieta.*—In Aguaprieta traveling salesmen are subject to a tax of 1 peso on each 1,000 pesos of their total sales.

*Hermosillo.*—Regulations fixed by the municipal president and council of Hermosillo require that traveling salesmen secure a license before calling on the trade, and pay a municipal tax of from 10 to 100 pesos for each time a visit is made to this political subdivision of Sonora. The exact amount of tax to be paid is fixed by the president and council. A fine of from 5 to 25 pesos is imposed for operating without a license. This ordinance is not always enforced.

*Guaymas.*—Old regulations requiring the payment of tax by salesmen are not enforced at Guaymas.

*State of Sinaloa.*—Municipalities in Sinaloa formerly required the payment of taxes by salesmen, varying in each subdivision, but these old ordinances are no longer enforced, although it is possible that salesmen might, from time to time, experience difficulty by reason of demands of local authorities.

*State of Nayarit.*—The municipal authorities in the State of Nayarit have the right to impose a tax on traveling salesmen, or those temporarily residing in the municipalities (counties) of the State, and payment in one municipality does not exempt a person from payment in another. At present some municipalities do not collect this tax, although they have the right to do so. When collected, it amounts to from 5 to 50 pesos per month. The municipality of Tepic charges a minimum of 5 pesos, to be paid by the traveler upon securing his license.

## COMMERCIAL ORGANIZATIONS.

Nogales, Hermosillo, Cananea, Guaymas, Culiacan, Mazatlan, and Tepic have legally constituted chambers of commerce, affiliated with the National Chamber of Commerce of Mexico, which has its headquarters in Mexico City and is, in reality, a semiofficial body empowered to pass economic and commercial resolutions that may be brought to the attention of the Congress or the Executive of the Nation.[1]

## EXPENSES IN CONNECTION WITH BUSINESS ESTABLISHMENTS.

The following statement shows the average annual overhead expense of a commercial business with a capital of $25,000 United States currency—a typical case for the West Coast:

| | |
|---|---|
| State taxes at 8 per cent annually | $200 |
| 60 per cent Federal tax on State tax | 120 |
| State tax of 2 per cent on retail sales, estimating that sales amount to $15,000 per year | 300 |
| Stamp tax on retail sales, at 5 mills annually | 75 |
| 60 per cent Federal tax on $300 | 180 |
| Municipal tax, considering the business of fifth class | 50 |
| 60 per cent Federal tax on $50 | 30 |
| Water service at $2.50 per month | 30 |
| Electric lights | 120 |
| One telephone | 53 |
| Rent of building | 900 |
| Interest on capital of $25,000 at 12 per cent | 3,000 |
| Salaries of office and store employees, including manager | 7,800 |
| Minor expenses, paper, stationery, fixtures, etc | 142 |
| Total expense | 13,000 |

Taking 25 per cent as the basis of profit on the cost price of the merchandise, it would require annual sales amounting to $75,000 to obtain a net profit of $5,750, not counting the $3,000 which the money invested would earn at 12 per cent per annum. In the above estimate, taxes on wholesale transactions are not included, as these are paid by the purchaser.

[1] Only the chambers of commerce of Guaymas and of Mazatlan are at all active at present, and only the chamber of commerce at Mazatlan is doing any work in connection with the collection of economic and commercial data, such as trade lists, directories, etc. The best source of local information for the salesman is the American consul. The American consulates are the only agencies on the West Coast that have been keeping up commercial and statistical work for the past 11 or 12 years, and they also have on hand the card files of the World Trade Directory covering their consular districts.

State governments in Mexico are seeking to cover large budgets passed by the new legislatures and, as a rule, pass special taxation laws which bear heavily on producing industries.

### FOREIGN COMPETITION.

On the West Coast the two chief items of Mexican domestic manufacture that compete most heavily with American imported goods are shoes and the cheaper grades of cotton textiles, such as the unbleached "manta," denims, etc. During the year and a half of economic depression throughout the country the domestic mills, located principally at Puebla, have accumulated large stocks of unsold merchandise for which an outlet is being sought, some being exported to Central America.

The local output of soaps also makes the importation of the cheaper grades from the United States impossible except along the border.

The domestic cotton mills are mostly badly equipped with old machinery, are poorly managed, and produce a very limited variety of goods. Labor troubles have seriously affected the industry, and a recent survey report showed that it was necessary for the industry to modernize its equipment, improve its technical forces, and turn out a wider variety of higher-grade goods. In the meantime the better and fancy grades of textiles continue to be imported in large amounts, constituting by far the largest single item of the country's imports of foreign merchandise and manufactures.

### GERMAN COMPETITION.

The German houses have long been dominant in Mexico in the wholesale and retail hardware trade, with the French leading in dry goods and the Spaniards in the foodstuffs and grocery lines. Prior to the Great War the West Coast of Mexico took more European than American goods, and little American merchandise was stocked or sold throughout this territory, which was, in reality, part of the Mexico City trade territory so far as commercial influence was concerned. The Great War, the disruption of industry in Europe, and the construction of the Southern Pacific Railroad down the West Coast changed all this very materially. Germany has not recovered its position in trade as was expected, and the railway has made the West Coast commercially tributary to California.

Immediately after the armistice exaggerated reports disseminated by the established German houses in Mexico led the buyers to believe that Germany would rapidly renew its foreign-trade activities, and the low rate of exchange for the German mark was an additional attraction. Large orders were placed in Germany and with the old German houses, the importers, in the meantime, continuing to place small orders for seasonal merchandise in the United States where they had been buying perforce during the war years. German deliveries did not materialize, and such goods as did eventually reach the West Coast (and other commercial centers of Mexico), after many months of delay, were very disappointing to the importers as to quality, especially in such lines as hardware, musical instruments, crockery and chinaware, glassware, photographic supplies, and machinery. German enameled ware continued to be very satisfactory as to quality, design, and price, and the American line can not compete successfully.

Judging by the number and nature of complaints on the West Coast against German houses during the past two years, the great German system of exporting, with its meticulous attention to the important details of packing, billing, drafts, etc., seems to have suffered a severe eclipse; or the present German exporting houses appear to be new to the foreign-trade field. Shipments have been held for months at Vera Cruz, running up large storage charges on account of faulty shipping and billing instructions, even when cash was paid with orders. Other shipments have been billed via New York and held up there. Very often goods, upon arrival, were found to be old and second hand, in such a bad condition as to be useless. In the meantime, trade has reverted to the United States in even larger proportions, and, moreover, present economic conditions make it imperative for the importer to order only small stocks of seasonal merchandise on which prompt delivery and a good assortment is always required and very necessary.

The Spaniards compete most heavily in canned and bottled foodstuffs, while the great French dry-goods houses of Mexico are active in the sale—in the interior and on the West Coast—of fancy dry-goods lines.

During 1922 a great number of German and British catalogues and price lists, accompanied by advertising matter, were being received by the merchants of the West Coast of Mexico, coming principally from representatives of German and English houses resident in Mexico City, a European house salesman being rarely seen on the coast since the war. Most of the importers have refused to purchase or order German goods on account of the absence of definite price quotations and the impossibility of estimating the time of delivery. Most of the European goods that have reached the West Coast since the war have been purchased from the larger importers of Mexico City.

### PROGRESS OF AMERICAN TRADE ON WEST COAST.

With the building of the railway down the coast from Guaymas in 1909 and coincident with the general growth of business and prosperity throughout the Pacific coast area of the United States, the jobbing and wholesale houses of Los Angeles and San Francisco became more and more active in their efforts to secure new trade down the West Coast. Export departments were organized and salesmen sent to the territory with the result that the great bulk of the trade of the coast is to-day controlled by these two American commercial centers. As an example of what has been accomplished by diligent effort, it may be stated that one Los Angeles wholesale drug house has secured what amounts to practically a monopoly of the drug and drug-sundry trade of the entire West Coast of Mexico, this house getting at least 85 per cent of the business in this line. Another large and active Los Angeles dry-goods house has secured a very large portion of the trade of the coast in its line and has been very successful in exporting to the entire West Coast of South America as far south as Santiago, Chile, very attractive business being secured in the large mining camps of Peru, etc. A Pacific coast manufacturer of workmen's clothing, also distributing allied lines of merchandise, has also succeeded in working up an excellent trade on the West Coast during the past few years.

San Francisco leads in the exportation of food products and heavy chemicals to the West Coast and in handling the imports from the West Coast.

As has been stated, the West Coast proper is to-day practically tributary commercial territory of the Pacific coast of the United States, and these commercial relations are being more and more intimately cemented by the increasing travel from the West Coast to California.

## TARIFF: CUSTOMS REGULATIONS, ETC.

The latest official publication of the Mexican tariff of import, and export duties is that issued in April 6, 1922—Tarifas de los Derechos de Importación y Exportación de la República Mexicana, published by Herrero Hermanos, Sucs., Mexico City (Apartado Postal 671). Special attention is called to the mention in this volume of the various important decrees issued in 1922 affecting import duties very materially.

Tariff-regulation changes have been so prolific in Mexico during the past year that it is not practical to give all of them here. They are published in Commerce Reports, and information may be obtained from the Division of Foreign Tariffs of the Bureau of Foreign and Domestic Commerce, Washington, D. C., or through the district or cooperative offices of the bureau.

Import duties are levied both specifically and on the gross, net, and "legal" weight of goods and materials imported. A few ad valorem duties have recently been established. In general, it may be said that the Mexican tariff regulations are, in their general policy, highly protective of domestic industries. Recent increases in certain commodity rates have been purely revenue-producing measures, and the rates have been placed at such a high figure that contraband has been increased to a very alarming extent.

## PRESENT COMMERCIAL CONDITIONS.

It was impossible in the late summer of 1922 to paint a bright picture of economic and commercial conditions throughout the West Coast of Mexico. The entire country began to feel the effects of 10 years of destruction of the means of production of national wealth, the exhaustion of the country's capital in the purchase abroad of even articles of first necessity formerly produced in abundance in the country, and the world-wide conditions that followed the collapse of the commodity markets in late 1920. The West Coast proper was also affected by the closing down of the great copper camps during a period of a year and a half and the practical stagnation of mining, which had been almost completely stopped for several years because of conditions of revolution in the country, only a few of the richer and more easily accessible properties being able to continue operating. Mining was also affected adversely by the low prices for silver and copper.

The Culiacan Valley had had two years of partial corn-crop failures due to lack of sufficient rainfall, and only the expenditure by the Government of more than 2,000,000 pesos for the construction of the canal there saved this region from complete economic collapse. The economic condition of the coast was also adversely affected by

the continued inability of the producers and agents to move the "garbanzo" crops for several years past at good prices, and there was a surplus production of rice in the Yaqui Valley in 1921. The same was true of the wheat crop of 1922.

Business conditions were very poor; buying was being done only in small lots of readily moved merchandise; because of the unemployment of labor there was but little money in circulation, and credit was very restricted, exporters to the West Coast limiting their efforts to collections of accounts due.

Interest rates quoted by the local branch banks and banking agencies were 1½ per cent per month, and then loans were made only on the best security and prime commercial paper.

The best-equipped mercantile establishments considered their wholesale general merchandise business to be, on the whole, slightly better than in 1921, but variously estimated that the total volume of business was only about 50 per cent as great as in 1910 (the year in which the revolutions began in Mexico) and that the amount of money taken in, considering the increase in prices since that time, was about 70 per cent as much.

An important factor in the present business situation of the West Coast is the fact that many of the weathier class of the population have left their former places of residence (or the country) and relatively few have returned as yet. A large number of these people are in the United States, chiefly residing in California, while many other families are living in the national capital, Mexico City. Such little buying as is being done is of the very cheapest grades of merchandise. Stocks of goods on hand in the wholesale places are small and do not offer a great range of variety. The general uncertainty of the national political situation is still being felt and further impairs confidence and curtails the placing of orders for large stocks of goods.

### TRAVELING TRADERS.

Considerable complaint was being made by the local merchants of the competition from the activities of the itinerant peddlers, or "falluqueros," as they are called, the business of such peddlers having been made possible during the various years of disturbed conditions when regular mercantile channels were disrupted. These peddlers penetrate to the small towns of the interior and also sell in the larger centers of population, realizing large profits on their small portable stocks by selling directly to the people. These traders buy their stocks at the border, principally in Nogales, from the jobbing houses there; and it was known that at least some of their goods found their way to the shelves of the smaller merchants in the cities at prices that made it impossible for legitimate dealers to compete.

The merchandise handled by the "falluqueros" consists principally of cotton goods, silk mixtures, laces, hosiery, women's slippers and shoes, general fancy notions and dry goods, perfumery, etc., and the volume of their total sales is very large.

### RESELLING METHODS.

American houses are granting West Coast importers 60 days from date of invoice in northern and central Sonora, and 60 days to 90

days at Guaymas and 90 days farther south along the coast. Wholesaling importers are granting 30, 60, and 90 days' credit to their buyers, who are the local retail dealers and the stores of the interior, with a 6 per cent interest charge on all overdue bills. Wholesalers have greatly curtailed credits in their districts, and customers are being selected with great care. It was reported that wholesalers could increase their sales by 200 per cent if they were willing to grant more credit to their prospective buyers. In this connection it should be borne in mind that many of the old, long-established houses have been discontinued or closed during the years of disturbed conditions, and their places have been taken by new and smaller firms established during the period of revolution, which are still rather unknown quantities from a credit standpoint, not having as yet built up a credit reputation.

During 1922 the bright spots of the West Coast were the Yaqui and Fuerte Valleys, both of which have been developed by American agricultural colonies. It is pertinent to state that the Fuerte Valley was the only place where automobiles were sold to any notable extent during the year.

## NOTES ON MARKETS FOR SPECIFIC COMMODITIES.

### AGRICULTURAL IMPLEMENTS AND MACHINERY.

The demand for agricultural implements and machinery has been especially poor, and dealers complained that they were not given adequate credit by American manufacturers and that because of their own lack of capital and high local interest rates they could not, in turn, extend credit to the farmers from one crop season to another. It was estimated that only one-tenth of the agricultural line was being sold as compared with the 10-year period prior to the revolutions.

An energetic advertising campaign was being made by certain large German manufacturers of agricultural implements and machinery, such as internal combustion motors, pumps, etc., these being offered on 6, 9, and even 12 months' time, and in some cases on consignment. Prices on German machinery, delivered at Manzanillo, were estimated to be slightly less than the American f. o. b. factory prices.

### AUTOMOBILES.

Because of the lack of good roads and even of proper pavement in the more populous towns and cities, and also on account of the greatly restricted buying power of the population and the absence of the wealthier class, practically no automobiles were being sold. All accessories are sold on a strictly cash basis.

### TEXTILES: DRY GOODS.

The cheaper grades of cotton cloth found in stocks on the West Coast are all from either the domestic mills or the United States. There formerly existed a very large trade in fancy dry goods and women's wear, but the demand has fallen off very considerably on account of present conditions and the fact that most of the wealthier people make periodical trips to California, where the entire family obtains the articles required for the season or the whole year.

### FOODSTUFFS.

Mazatlan imports fairly large quantities of American potatoes, apples, and flour. All package groceries sold are of American manufacture, as well as canned goods, with the exception of certain high-priced tinned and bottled goods such as Spanish sardines and olive oil. The Chinese are the largest grocery and food-supply dealers on the West Coast, with the exception of two large Spanish houses in Mazatlan.

### HARDWARE.

Several German salesmen, representing Mexico City German hardware-importing houses, have covered the West Coast recently and sold principally builders' hardware of light weight and cheap quality. The dealers admit that American tools are superior in quality, utility, design, and appearance, and they stock them exclusively. German enameled ware is sold at lower prices than the American and is of better design and quality. English-made chains are sold more cheaply than American make.

### DRUGS AND MEDICINES.

With few exceptions all drugs and medicines on the West Coast are American, purchased from wholesale houses in the United States.

## COMMERCIAL RELATIONS WITH AMERICAN FIRMS IN GENERAL.

In general, the merchants of the West Coast express themselves as being well satisfied with their commercial relations with American exporting firms. Some of these Mexican houses have held the same American agencies for 20 or even 30 years. From some of the smaller houses there is complaint of the lack of credit granted by American exporters, but the larger and longer-established houses of the West Coast state that under present economic conditions in the country they prefer to pay cash for all merchandise purchased, thus avoiding heavy obligations likely to cause embarrassment through poor collections in their own commercial regions.

As a matter of fact, the adequate capital of the larger houses is their best insurance of control of the wholesale trade of their districts, as they are able to finance their term sales to the interior and to local retail dealers and do not have to do this with credit secured from the exporter, as the smaller firms desire to do.

In years gone by, salesmen for European houses allowed a system of bargaining, based principally on special discounts consistent with the volume of orders, etc., and there was always some special feature to be offered to each large buyer. Both buyer and seller enjoyed the "trading" feature, and there is some complaint to the effect that American houses have inflexible price lists and a "take it or leave it" attitude. However, the old order of things has passed on the West Coast, after its contact with the United States, more rapidly than it has in the rest of Latin America, and in the long run the short-term credit, with quick deliveries, fixed prices, and uniform treatment of all customers, is by far the most beneficial policy for all concerned. This difficulty can be greatly discounted by American salesmen through cultivating the personal relation in every case.

## FUTURE NEEDS AND PROSPECTS.

Aside from the great necessity (already mentioned) for the development of some additional product or products of export and the urgent need for the railway connection with Guadalajara and the interior of the Republic, the West Coast needs adequate banking facilities. No greater impulse could be given the industries of the territory than the establishment of a large American branch bank equipped to handle the demands of the mining, agricultural, and manufacturing industries as well as those of commerce and trade. The effect of such an institution has been observed in Colombia and Venezuela and other Latin American countries where more or less similar conditions prevail, and it is very unfortunate that present conditions in Mexico and current legislation in that country preclude, for the time at least, the establishment of such a branch bank on the West Coast.

Universally throughout the West Coast, Mexican mining men, merchants, landowners, and professional people all agreed that the country was only waiting for the return of American capital and enterprise, and that they themselves did not have sufficient capital or experience to develop the natural resources of the region.

The opening of the Cananea copper mines in August, 1922, had a tremendous effect on the entire West Coast, as it indicated an improvement in the metal market and also—of still greater importance—a return of confidence in conditions in Mexico in general. Exports of silver and gold had been increasing steadily during the first half of the year, a phenomenal increase over the previous low record being noted toward the end of the half year, clearly indicating a resumption of mining activities, in Sonora principally. The last of the previous year's "garbanzo" crop had moved to Spain and the West Indies, and the large wheat crop of Sonora, fair corn and bean crops in Sinaloa and Nayarit, and the greatly increased acreage in winter tomatoes and vegetables for export to the United States were also favorable conditions.

Buying of agricultural implements and machinery, mining machinery, and miscellaneous equipment had already started in October, 1922, and larger demands for general merchandise were predicted for the last of the year and during the early months of 1923. Development is sure to come in the banana industry in Nayarit, and this will give the West Coast a new and stable industry—something it most needs. A large hydroelectric plant is planned for Sinaloa.

It should be borne in mind, however, that some of the surplus earned in the 1922–23 crop season and the increased influx of money due to the partial resumption of mining will have to go toward the satisfaction of old accounts pending and therefore can not all be put into new stocks of goods or enterprises. Considering the situation of the West Coast broadly, it may be predicted that that commercial territory of Mexico will take, during 1923, at least twice as much imported merchandise as during 1922 or 1921.

In order better to protect their wholesale business against the policy of the smaller American jobbing houses of Arizona and California which sell to the smaller importers of the West Coast on credit terms, several of the larger houses in Hermosillo and Mazatlan have

opened their own offices in San Francisco, from which relations with American producers are cultivated and the buying done for their West Coast stocks. In handling their shipments in this manner, proper supervision is exercised over the important items of packing, consular invoicing for customs, etc., and better advantage is taken of commodity market conditions in the producing centers of the United States.

From the standpoint of the exporter, the West Coast of Mexico is not an unlimited commercial market and should be considered as only one section of a much wider field which should extend to the Guadalajara district and down the west coast of both Central and South America. Merchandising, as has been said, is, if anything, overdone, and the relative purchasing power of the people, per capita, is low. A good trade with the West Coast can be developed only by slow and painstaking work based on the cultivation of the personal relation, real commercial service to the buyers, and a careful consideration of credit allowances incident to a knowledge of the economic conditions.

The development of the West Coast as a larger market for imported goods and materials depends upon the policy of the Government and people with regard to foreigners, property ownership, and the colonization of the river valleys by foreign farmers.

## FOREIGN-TRADE FIGURES.

The tables in the succeeding pages will furnish the data on which to base estimates of the volume of trade in each line of exports and imports of the West Coast.

The following table shows the quantity and value of declared exports from the various American consular districts to the United States during the years ended December 31, 1921 and 1922:[13]

EXPORTS INVOICED AT NOGALES CONSULATE.

| Articles. | 1921 | | 1922 | |
|---|---|---|---|---|
| | Quantity. | Value. | Quantity. | Value. |
| Animals and animal products: | | | | |
| Bones....tons.. | 2 | $524 | 251 | $3,312 |
| Cattle....head.. | 4,980 | 151,909 | 9,548 | 136,633 |
| Cheese....pounds.. | 1,220 | 199 | ..... | ..... |
| Guano....tons.. | 220 | 7,383 | 336 | 7,767 |
| Fish....pounds.. | ..... | ..... | 2,204 | 185 |
| Hides— | | | | |
| Dry....do.... | ..... | ..... | 36,620 | 3,164 |
| Green....do.... | ..... | ..... | 330,407 | 20,592 |
| Hogs....head.. | ..... | ..... | 207 | 2,544 |
| Horses....do.... | 8 | 653 | 5 | 135 |
| Leather....pounds.. | ..... | ..... | 114,718 | 23,027 |
| Oysters....do.... | 800 | 150 | ..... | ..... |
| Shrimps....do.... | 2,513 | 747 | 9,814 | 1,696 |
| Farm products, fruit, etc.: | | | | |
| Bananas....pounds.. | ..... | ..... | 3,520 | 176 |
| Beans....bushels.. | 1,646 | 4,421 | 25 | 68 |
| Bran....tons.. | 96 | 3,151 | 188 | 4,749 |
| Cantaloupes....pounds.. | 436 | 100 | 1,269,397 | 71,880 |
| Corn....bushels.. | ..... | ..... | 623 | 438 |
| Cucumbers....pounds.. | 23,037 | 1,392 | 72,566 | 2,736 |

[13] The export returns at the American consulates at Nogales, Guaymas, and Mazatlan do not always indicate the actual amounts of commodities exported from each consular district, as commodities originating in northern Sinaloa (and thus coming under the consular jurisdiction of the Mazatlan district, which includes the States of Sinaloa and Nayarit) may be declared at Nogales for convenience of the shippers—the same condition applying to the commodities originating in the Hermosillo district which belongs to the Guaymas consular district.

EXPORTS INVOICED AT NOGALES CONSULATE—Continued.

| Articles. | | 1921 | | 1922 | |
|---|---|---|---|---|---|
| | | Quantity. | Value. | Quantity. | Value. |
| Farm products, fruit, etc.—Continued. | | | | | |
| Egg plant | pounds | 14,024 | $952 | 40,194 | $1,210 |
| Garlic | do | 16,989 | 638 | 48,793 | 2,901 |
| Hay | tons | 36 | 1,039 | ..... | ..... |
| Okra | pounds | ..... | ..... | 2,140 | 80 |
| Onions | bushels | ..... | ..... | 910 | 1,264 |
| Peas— | | | | | |
| Blackeye | do | 5,569 | 20,088 | 15,255 | 41,146 |
| Garbanzo | do | 158,724 | 259,634 | 389,934 | 927,655 |
| Green | do | 6 | 35 | 781 | 1,667 |
| Peppers— | | | | | |
| Chile | pounds | 9,396 | 2,298 | 5,208 | 1,592 |
| Green | do | 153,869 | 10,224 | 852,446 | 36,533 |
| Pineapples | do | 178 | 25 | ..... | ..... |
| Pumpkins | do | 900 | 9 | ..... | ..... |
| Rice | do | 1,676,340 | 148,788 | 2,424,406 | 97,031 |
| Sugar— | | | | | |
| Panocha | do | 240,006 | 16,998 | 222,852 | 12,249 |
| Refined | do | 24,366,676 | 2,475,402 | 43,044,087 | 2,995,404 |
| Tomatoes | bushels | 297,861 | 630,671 | 400,987 | 762,865 |
| Watermelons | pounds | 437,207 | 15,779 | 302,985 | 9,149 |
| Forestry products: | | | | | |
| Brazil dyewood | tons | 581 | 10,776 | 1,338 | 23,348 |
| Cedar logs | cubic feet | 41,892 | 14,583 | 394,565 | 50,670 |
| Mahogany logs | do | 1,574 | 544 | ..... | ..... |
| Mora dyewood | tons | 380 | 9,288 | 1,733 | 31,300 |
| Wood, fire | cubic feet | 64,000 | 4,040 | 128,000 | 5,873 |
| Minerals, metals, etc.: | | | | | |
| Brick | thousands | 300 | 3,910 | 41 | 423 |
| Clay | tons | ..... | ..... | 20 | 415 |
| Copper— | | | | | |
| Bullion | pounds | 9,104 | 1,177 | ..... | ..... |
| Ore | do | ..... | ..... | 3,660 | 517 |
| Diamond, cut | number | 1 | 260 | ..... | ..... |
| Gold— | | | | | |
| Amalgam | ounces | ..... | ..... | 102 | 2,032 |
| Bullion | do | 21,868 | 443,838 | 20,577 | 414,962 |
| Concentrates | do | 1,956 | 39,349 | 240 | 4,813 |
| Cyanides | do | ..... | ..... | 9 | 188 |
| Ore | do | ..... | ..... | 411 | 9,045 |
| Placer | do | ..... | ..... | 88 | 1,762 |
| Precipitates | do | 346 | 7,130 | 10 | 201 |
| Slag | do | 441 | 8,214 | 113 | 2,273 |
| Sulphides | do | 310 | 6,208 | 126 | 2,544 |
| Graphite ore | tons | 3,045 | 120,781 | 1,369 | 36,662 |
| Iron, scrap | do | 122 | 3,800 | 390 | 4,716 |
| Lead | pounds | 16,693 | 707 | 37,511 | 986 |
| Lime | do | 87,670 | 415 | 92,000 | 472 |
| Silver— | | | | | |
| Amalgam | ounces | ..... | ..... | 1,564 | 1,030 |
| Bullion | do | 801,587 | 527,351 | 730,369 | 493,494 |
| Coin | do | 10,130 | 9,768 | ..... | ..... |
| Concentrates | do | 96,860 | 63,014 | 126,665 | 84,991 |
| Cyanides | do | ..... | ..... | 6,161 | 4,268 |
| Ore | do | ..... | ..... | 50,185 | 33,146 |
| Precipitates | do | 9,889 | 5,979 | 6,569 | 4,557 |
| Slag | do | 568 | 414 | 41 | 27 |
| Sulphides | do | 332,965 | 204,692 | 44,943 | 30,175 |
| Tungsten | pounds | 4,134 | 670 | ..... | ..... |
| Miscellaneous: | | | | | |
| Films | rolls | ..... | ..... | 13 | 4,806 |
| All other | | ..... | 2,005 | ..... | 905 |
| Total | | ..... | 5,241,912 | ..... | 6,420,452 |
| Returned American goods | | ..... | 33,270 | ..... | 21,249 |
| Grand total | | ..... | 5,275,182 | ..... | 6,441,701 |

EXPORTS INVOICED AT CANANEA AGENCY (NOGALES CONSULAR DISTRICT).

| Articles. | 1921 | | 1922 | |
|---|---|---|---|---|
| | Quantity. | Value. | Quantity. | Value. |
| Animals and animal products: | | | | |
| Bones, dry ..... pounds.. | 40,000 | $302 | 90,000 | $889 |
| Cattle ..... head.. | 8,560 | 195,519 | 9,811 | 115,102 |
| Hides— | | | | |
| Dry, cattle ..... pounds.. | 19,936 | 1,964 | 1,706 | 319 |
| Salt, cattle ..... do.... | ..... | ..... | 1,288 | 3,505 |
| Wild animal ..... do.... | 25 | 46 | ..... | ..... |
| Horns, cow ..... do.... | ..... | ..... | 83 | 170 |
| Horses, Shetland ponies ..... head.. | ..... | ..... | 80 | 2,002 |
| Tails, cow ..... pounds.. | 1,047 | 79 | 262 | 31 |
| Farm products, fruit, etc.: | | | | |
| Onions, dry ..... bushels.. | 357 | 492 | ..... | ..... |
| Potatoes, Irish ..... do.... | 489 | 294 | ..... | ..... |
| Sugar, "panocha" ..... pounds.. | 550 | 32 | ..... | ..... |
| Forestry products: | | | | |
| Wood, fire ..... cubic feet.. | ..... | ..... | 3,072 | 480 |
| Minerals, metals, etc.: | | | | |
| Copper— | | | | |
| Bullion ..... pounds.. | 3,185,532 | 489,162 | 10,073,338 | 1,352,180 |
| Concentrates ..... do.... | ..... | ..... | 4,682 | 647 |
| Gold— | | | | |
| Bullion ..... ounces.. | 324 | 7,275 | 1,037 | 21,253 |
| Concentrates ..... do.... | 223 | 2,610 | ..... | ..... |
| Ore ..... do.... | 12 | 237 | 37 | 678 |
| Lead concentrates ..... pounds.. | ..... | ..... | 547,302 | 38,183 |
| Silver— | | | | |
| Bullion ..... ounces.. | 89,397 | 65,836 | 257,777 | 174,224 |
| Concentrates ..... do.... | 4,745 | 3,215 | 12,281 | 8,872 |
| Ore ..... do.... | 5,834 | 2,367 | 6,277 | 3,885 |
| Zinc ..... pounds.. | ..... | ..... | 88,428 | 7,082 |
| Total ..... | ..... | 769,430 | ..... | 1,729,502 |
| Returned American goods ..... | ..... | 68,244 | ..... | 4,965 |
| Grand total ..... | ..... | 837,674 | ..... | 1,734,467 |

EXPORTS INVOICED AT AGUA PRIETA AGENCY (NOGALES CONSULAR DISTRICT)

| | | | | |
|---|---|---|---|---|
| Animals and animal products: | | | | |
| Cattle ..... head.. | 631 | $22,087 | 3,031 | $45,523 |
| Guano ..... tons.. | 12 | 1,202 | ..... | ..... |
| Hides and skins ..... pounds.. | ..... | 1,202 | 10,179 | 743 |
| Horses ..... head.. | ..... | ..... | 6 | 311 |
| Farm products, fruit, etc.: | | | | |
| Bran, wheat ..... tons.. | 200 | 5,133 | 587 | 14,591 |
| Sugar, refined ..... pounds.. | ..... | ..... | 263,449 | 13,240 |
| Forestry products: | | | | |
| Wood, fire ..... cubic feet.. | 25,344 | 983 | 4,608 | 182 |
| Minerals, metals, etc.: | | | | |
| Copper— | | | | |
| Concentrates ..... pounds.. | 10,726,550 | 1,182,493 | 19,928,440 | 2,192,618 |
| Matte ..... do.... | ..... | ..... | 1,200 | 161 |
| Ore ..... do.... | 79,980 | 9,274 | 167,016 | 19,757 |
| Gold— | | | | |
| Bullion ..... ounces.. | ..... | ..... | 407 | 8,150 |
| Concentrates ..... do.... | 23,933 | 478,655 | 25,609 | 512,184 |
| Ore ..... do.... | 4,181 | 83,629 | 4,532 | 90,639 |
| Precipitates ..... do.... | 5 | 95 | 30 | 610 |
| Lead— | | | | |
| Concentrates ..... pounds.. | 1,223,290 | 40,747 | 1,239,640 | 41,245 |
| Ore ..... do.... | 157,200 | 5,298 | 180,055 | 5,793 |
| Molybdenum— | | | | |
| Concentrates ..... pounds.. | 3,375 | 2,268 | 10,500 | 5,362 |
| Ore ..... do.... | 7,163 | 3,445 | 1,380 | 630 |
| Silver— | | | | |
| Bullion ..... ounces.. | ..... | ..... | 4,192 | 2,880 |
| Concentrates ..... do.... | 3,083,846 | 1,722,649 | 3,410,779 | 2,232,512 |
| Matte ..... do.... | ..... | ..... | 400 | 301 |
| Ore ..... do.... | 568,896 | 330,264 | 705,699 | 471,301 |
| Precipitates ..... do.... | 761 | 517 | 5,492 | 3,844 |
| All other ..... do.... | ..... | 431 | ..... | ..... |
| All other ..... | ..... | 1,727 | ..... | 1,457 |
| Total ..... | ..... | 3,892,099 | ..... | 5,664,034 |
| Returned American goods ..... | ..... | 93,080 | ..... | 29,764 |
| Grand total ..... | ..... | 3,985,179 | ..... | 5,693,798 |

## EXPORTS INVOICED AT GUAYMAS CONSULATE.

| Articles. | 1921 | | 1922 | |
|---|---|---|---|---|
| | Quantity. | Value. | Quantity. | Value. |
| Bones.....pounds.. | ..... | ..... | 19,676 | $197 |
| Bullion: | | | | |
| Gold.....ounces.. | 38 | $778 | ..... | ..... |
| Silver.....do.... | 2,348 | 1,610 | 27,600 | 16,560 |
| Coffee.....pounds.. | ..... | ..... | 105,588 | 15,568 |
| Copper: | | | | |
| Bars, blister.....do.... | 11,856,699 | 1,414,643 | 574,171 | 51,578 |
| Matte.....do.... | 1,929,983 | 97,624 | 14,080,436 | 683,007 |
| Cylinders, empty.....number.. | ..... | ..... | 5 | 150 |
| Fish, dried.....pounds.. | 5,966 | 6,079 | ..... | ..... |
| Garbanzos.....do.... | 910,600 | 44,351 | 39,400 | 4,052 |
| Graphite.....tons.. | 210 | 1,693 | ..... | ..... |
| Guano, bat.....tons.. | 232 | 1,112 | ..... | ..... |
| Horns.....pounds.. | 17,460 | 790 | ..... | ..... |
| Leather, sole.....do.... | 21,966 | 8,333 | 18,202 | 5,998 |
| Ore, silver-gold.....tons.. | 2 | 628 | ..... | ..... |
| Pearls.....number.. | 24 | 1,922 | 94 | 11,128 |
| Pepper, red.....pounds.. | 2,670 | 321 | ..... | ..... |
| Precipitates, silver.....do.... | ..... | ..... | 87 | 630 |
| Shrimps, dried.....do.... | 2,270 | 327 | ..... | ..... |
| Specimens: | | | | |
| Indian.....cases.. | 8 | 385 | ..... | ..... |
| Natural history.....do.... | ..... | ..... | 47 | ..... |
| Tomatoes.....pounds.. | 74,340 | 2,546 | 200,580 | 7,200 |
| Tubes, old.....do.... | ..... | ..... | 54,160 | 271 |
| Total | ..... | 1,583,142 | ..... | 796,339 |
| Returned American goods | ..... | 10,954 | ..... | 16,113 |
| Grand total | ..... | 1,594,096 | ..... | 812,452 |

## EXPORTS INVOICED AT MAZATLAN CONSULATE.

| | | | | |
|---|---|---|---|---|
| Bananas.....bunches.. | ..... | ..... | 135 | $96 |
| Bullion: | | | | |
| Silver.....ounces.. | 2,239,951 | $1,404,528 | 2,781,162 | 1,919,319 |
| Gold.....do.... | 48,696 | 957,095 | 53,061 | 1,122,689 |
| Cantaloupes.....boxes.. | ..... | ..... | 1,471 | 5,788 |
| Chili.....pounds.. | ..... | ..... | 3,095 | 1,424 |
| Coconuts.....number.. | ..... | ..... | 18,918 | 595 |
| Coffee.....pounds.. | 102,031 | 12,809 | 13,528 | 2,084 |
| Concentrates and ores: | | | | |
| Silver.....ounces.. | 138,445 | 86,959 | 178,999 | 122,495 |
| Gold.....do.... | 1,431 | 28,313 | 2,433 | 55,624 |
| Copper.....pounds.. | 21,095 | 2,453 | 29,228 | 2,415 |
| Lead.....do.... | 28,777 | 865 | 58,722 | 3,150 |
| Zinc.....do.... | 10,181 | 242 | 11,974 | 675 |
| Drums, empty.....number.. | 19 | 168 | 34 | 521 |
| Fins, shark.....pounds.. | 800 | 938 | 2,041 | 1,689 |
| Fish, salt.....do.... | 143,375 | 9,768 | 149,895 | 13,143 |
| Fusel oil.....gallons.. | ..... | ..... | 345 | 217 |
| Furniture.....pieces.. | ..... | ..... | 13 | 288 |
| Glycerin, crude.....pounds.. | ..... | ..... | 41,087 | 3,698 |
| Hides: | | | | |
| Alligator.....do.... | 1,861 | 120 | ..... | ..... |
| Cow.....do.... | ..... | ..... | 955 | 565 |
| Deerskins.....do.... | 1,377 | 892 | ..... | ..... |
| Shark skins.....do.... | 698 | 107 | ..... | ..... |
| Honey.....do.... | 8,500 | 1,510 | ..... | ..... |
| Ixtle fiber.....do.... | 745,633 | 38,944 | 1,103,307 | 77,217 |
| Logs: | | | | |
| Cedar.....board feet.. | 6,215 | 120 | 102,303 | 3,594 |
| Amapa.....do.... | ..... | ..... | 20,880 | 514 |
| Brazil dyewood.....tons.. | ..... | ..... | 505 | 2,745 |
| Mixed plates: | | | | |
| Silver.....ounces.. | 1,966 | 1,194 | ..... | ..... |
| Gold.....do.... | 12 | 237 | ..... | ..... |
| Zinc.....pounds.. | 9,187 | 188 | ..... | ..... |
| Dyewood extract.....do.... | ..... | ..... | 98,877 | 9,010 |
| Miscellaneous.....do.... | ..... | ..... | 1,369 | 1,274 |
| Oregano.....do.... | ..... | ..... | 1,903 | 157 |
| Oysters.....do.... | 211 | 32 | 200 | 30 |
| Pearls.....number.. | 17 | 500 | ..... | ..... |
| Pepper.....pounds.. | 831 | 665 | 2,572 | 1,413 |
| Personal effects.....do.... | 611 | 503 | ..... | ..... |
| Shrimp, dried.....do.... | 100,566 | 17,842 | 343,605 | 54,916 |
| Currency, American | ..... | 15,556 | ..... | ..... |
| Stomachs, fish.....pounds.. | 37 | 7 | ..... | ..... |
| Tomatoes.....do.... | 3,052,060 | 79,872 | 3,135,230 | 100,566 |
| Turpentine, crude.....do.... | ..... | ..... | 275 | 31 |
| Vegetables.....do.... | ..... | ..... | 540 | 14 |
| Total | ..... | 2,662,427 | ..... | 3,507,956 |
| Returned American goods | ..... | 21,084 | ..... | 29,600 |
| Grand total | ..... | 2,683,511 | ..... | 3,537,556 |

The Mexican Government official returns covering imports into that country do not segregate commodities except by the grand divisions of "Animal products," "Vegetable products," etc. The table below gives a detailed statement of commodities imported into the West Coast of Mexico by rail for the years 1920 and 1921 and is the only available material that shows the relative values of the many different classes of merchandise taken by the West Coast. It will be noted that textiles take the leading place over all other commodities, constituting roughly 8.5 per cent of the total, and that the various items of foodstuffs form, in their aggregate value, about 13.1 per cent of the total for 1920. It should be understood that this table represents principally goods brought into Mexico for immediate consumption in northeastern, northern, and central Sonora, and that a large volume of similar goods was also sold to Sonora through the port of entry of Douglas, Ariz. (Agua Prieta, Sonora).

It is apparent that the amount of foodstuffs imported into Mexico from the United States and other countries has been steadily increasing during the years of revolution, which have caused the curtailment of the production even of the chief staples all over that country, necessitating large imports of foodstuffs that were not formerly brought in. This statement must be qualified, however, with the additional explanation that practically all of the State of Sonora, with the exception of the irrigated sections of the Yaqui and Mayo Valleys, is a desert country with a very small production of foodstuffs other than wheat and beef cattle, and that the various mining camps take large quantities of canned and package foodstuffs.

The year 1921 has seen some increased movement by water to the ports of Guaymas and Mazatlan, thereby reducing the movement by rail through the Arizona district. However, the main cause of the big decrease—shown below—in the rail shipments to the West Coast is the decreased purchasing power of that region, caused principally by the shutting down of the mines during 1921, and also due to lack of market for the products of the West Coast. The imports from Mexico into the Arizona district of the United States in 1921 were the lowest in many years, and this fully explains the decrease in goods purchased by the Mexicans.

The following table shows the American goods purchased by the West Coast as moved by rail (large items only, no sales under $10 being included):

| Articles. | 1920 | 1921 | Articles. | 1920 | 1921 |
|---|---|---|---|---|---|
| Acids | $43,237 | $18,219 | Candles | $4,576 | $2,095 |
| Agricultural implements | 243,373 | 116,463 | Carbide | 52,558 | 7,827 |
| Animals | 128,558 | 145,408 | Castings | 28,807 | 9,710 |
| Asbestos goods | 13,540 | 4,737 | Cash registers and adding machines | 12,586 | 6,687 |
| Athletic goods | 45,118 | 12,444 | Celluloid products | 18,238 | 1,983 |
| Automobiles, passenger | 121,336 | 114,060 | Cement | 114,168 | 89,895 |
| Autotrucks | 96,322 | 24,907 | Cereal products | 32,815 | 14,526 |
| Auto accessories | 63,516 | 45,512 | Chains | 13,929 | 12,860 |
| Babbitt and other metals | 21,886 | 5,664 | Cheese | 11,496 | 29,997 |
| Bags | 110,186 | 48,488 | Chemicals | 126,395 | 164,661 |
| Baking powder | 11,450 | 8,775 | China and earthenware | 34,758 | 20,475 |
| Bicycles | 1,879 | 2,474 | Clocks and watches | 8,710 | 3,407 |
| Blacking | 8,011 | 5,829 | Coal | 123,222 | 179,324 |
| Box shooks | 248,420 | 142,926 | Cocoa | 11,011 | 3,917 |
| Brass goods | 29,203 | 20,511 | Coffee | 82,414 | 22,329 |
| Blankets | 74,605 | 20,152 | Coke | 765,120 | 2,571 |
| Brick | 35,370 | 35,188 | Confectionery | 9,896 | 7,671 |
| Bread | 29,302 | 16,698 | Copper goods | 21,238 | 28,580 |
| Brooms and brushes | 6,672 | 8,790 | Cordage and twine | 46,517 | 25,064 |
| Buttons | 9,676 | 9,115 | Drugs and toilet articles | 94,089 | 66,711 |
| Butter | 35,509 | 26,623 | | | |

| Articles. | 1920 | 1921 | Articles. | 1920 | 1921 |
|---|---|---|---|---|---|
| Dry goods | $1,067,569 | $1,183,019 | Paper products | $171,698 | $104,985 |
| Dyestuffs | 2,256 | 4,425 | Perfumeries | 24,744 | 20,403 |
| Eggs | 195,301 | 100,199 | Phonographs | 9,178 | 24,878 |
| Electrical supplies | 118,809 | 207,932 | Photographic supplies | 12,169 | 8,854 |
| Electrical machinery | 153,715 | 56,340 | Pickles | 7,424 | 2,145 |
| Explosives | 514,558 | 194,151 | Pipe | 192,009 | 111,199 |
| Extracts | 10,226 | 5,454 | Plumbing | 50,920 | 29,714 |
| Fish, dried and canned | 46,750 | 23,083 | Refrigerators | 2,892 | 2,296 |
| Flour | 397,049 | 156,126 | Roofing material | 21,569 | 12,938 |
| Furniture | 86,304 | 35,128 | Rubber belting | 71,074 | 17,316 |
| Fruits: | | | Rubber goods | 59,921 | 40,629 |
| Dried | 17,073 | 8,406 | Salt | 12,525 | 5,300 |
| Fresh | 57,469 | 25,153 | Scales | 9,031 | 25,070 |
| Canned | 7,594 | 7,280 | Scientific instruments | 25,729 | 18,436 |
| Glass and glassware | 88,740 | 63,602 | Seed | 17,684 | 19,253 |
| Grain | 23,605 | 265,942 | Shoes | 531,490 | 324,747 |
| Hams and bacon | 24,810 | 15,403 | Soap | 376,041 | 157,574 |
| Hardware, shelf | 93,139 | 99,591 | Spices | 9,730 | 5,063 |
| Hay | 31,065 | 48,796 | Stationery and books | 95,061 | 74,051 |
| Horseshoes | 15,833 | 6,791 | Steel plates and sheets | 85,483 | 79,119 |
| Iron and steel | 429,043 | 259,863 | Stoves | 22,789 | 13,065 |
| Iron bolts, screws, and nails | 92,272 | 64,789 | Sugar and sirups | 23,015 | 37,941 |
| Iron, pig | 20,504 | 2,932 | Tin plate | 49,558 | 3,706 |
| Jewelry | 4,144 | 2,155 | Tinware | 8,087 | 5,448 |
| Lamps (not electric) | 28,097 | 20,165 | Tires and tubes | 106,037 | 74,334 |
| Lard | 362,047 | 517,892 | Tobacco | 21,286 | 11,175 |
| Leather goods | 59,368 | 30,944 | Tools | 119,089 | 69,851 |
| Lubricating grease | 24,300 | 20,327 | Toys | | 8,847 |
| Lumber | 842,351 | 297,162 | Trunks | 20,578 | 14,534 |
| Machinery | 1,645,679 | 1,634,836 | Typewriters | 27,369 | 27,663 |
| Matches | 26,424 | 20,579 | Vegetables, canned | 14,996 | 9,023 |
| Meats, canned | 20,970 | 12,872 | Wagons | 93,102 | 56,585 |
| Milk | 115,318 | 70,997 | Waste, mill | 10,882 | |
| Musical instruments | 18,636 | 24,109 | Wearing apparel | 700,835 | 502,470 |
| Nuts | 38,858 | 3,032 | Wheelbarrows | 4,490 | 1,186 |
| Oils and gasoline | 402,102 | 253,222 | Wire and wire goods | 92,425 | 141,199 |
| Oilcloth | 8,890 | 8,155 | Wood manufatures | 77,929 | 110,519 |
| Paints and varnish | 66,987 | 49,361 | Total | 13,325,866 | 9,505,602 |

NOTE.—The above figures were compiled by the foreign-trade department of the Nogales Chamber of Commerce, Nogales, Ariz.

Imports and exports through the various Mexican customs districts and ports in Sonora, Sinaloa, Nayarit, and Lower California during 1921, according to official Mexican Government figures, are shown in the table below (some of the smaller customs offices were reopened during 1921, and the figures credited to them are not for the full year):

| Ports. | Imports. | | Exports. | |
|---|---|---|---|---|
| | Kilos. | Pesos. | Kilos. | Pesos. |
| PACIFIC PORTS. | | | | |
| Bahia Magdalena (Lower California) | $77,797 | $13,530 | $548,782 | $9,243 |
| Ensenada (Lower California) | 2,572,181 | 709,319 | 663,444 | 144,847 |
| Guaymas (Sonora) | 2,387,666 | 821,090 | 131,813 | 42,672 |
| La Paz (Lower California) | 2,721,209 | 1,025,333 | 174,799 | 1,070,851 |
| Mazatlan (Sinaloa) | 11,006,940 | 4,963,534 | 371,696 | 4,690,657 |
| San Blas (Nayarit) | 1,012,229 | 352,536 | 745,629 | 18,373 |
| San Jose del Cabo (Lower California) | 111,310 | 37,731 | 560,362 | 9,961 |
| Santa Rosalia (Lower California)[1] | 14,278,240 | 1,383,843 | 5,074,637 | 3,055,934 |
| Topolobampo (Sinaloa) | 897,831 | 233,547 | 86,072 | 39,457 |
| Total | 35,065,403 | 9,540,463 | 8,358,234 | 9,081,995 |
| NORTHERN BORDER. | | | | |
| Agua Prieta (Sonora) | 15,242,151 | 1,979,415 | 1,309,580 | 27,179 |
| Mexicali (Lower California) | 8,258,677 | 1,282,483 | 63,478,471 | 6,800,178 |
| Naco (Sonora) | 3,643,671 | 537,551 | 3,737,195 | 3,396,057 |
| Nogales (Sonora) | 58,432,933 | 9,161,713 | 14,735,409 | 4,047,476 |
| Sasabe (Sonora) | 39,798 | 11,995 | 25,882 | 105,876 |
| Tecate (Lower California) | 123,516 | 8,252 | | |
| Tia Juana (Lower California) | 1,471,541 | 266,611 | 170,322 | 33,852 |
| Total | 87,212,287 | 13,248,020 | 83,456,859 | 14,410,618 |
| Grand total | 122,277,690 | 22,788,483 | 91,815,093 | 23,492,613 |

[1] The largest item of importation at Santa Rosalia consists of machinery and equipment for the copper mines of the Boleo Co.

For purposes of comparison, figures for earlier years are given below.

The total imports into Mexico for the calendar year 1918 were valued at 276,217,464 pesos (1 peso = $0.50 at par) and in 1919 at 237,038,347 pesos.

The following table of imports shows the relative importance of various ports of entry in western Mexico (including several that are outside the specific region covered by the present monograph):

| Ports. | 1918 | 1919 | Ports. | 1918 | 1919 |
|---|---|---|---|---|---|
| PACIFIC PORTS. | | | PACIFIC PORTS.—Con. | | |
| Acapulco (State of Guerrero) | 133,247 | 427,486 | San Jose del Cabo | 40,465 | ..... |
| Bahia Magdalena | 3,435 | 20,881 | Santa Rosalia | 2,394,725 | 1,585,543 |
| Ensenada | 511,161 | 545,396 | Topolobampo | 105,532 | 290,794 |
| Guaymas | 399,291 | 1,048,539 | Total | 18,800,856 | 17,025,274 |
| La Paz | 367,237 | 714,955 | | | |
| Manzanillo (State of Colima) | 5,412,162 | 3,659,941 | BORDER PORTS OF SONORA. | | |
| Mazatlan | 4,882,997 | 5,123,867 | | | |
| Puerto Angel (State of Oaxaca) | 18,880 | 47,923 | Agua Prieta (Douglas) | 5,801,210 | 3,641,060 |
| Salina Cruz (State of Oaxaca) | 4,252,082 | 2,996,459 | Naco (Cananea) | 2,974,043 | 3,259,952 |
| San Blas | 279,642 | 563,490 | Nogales (Nogales)[1] | 2,595,082 | 4,169,914 |
| | | | | 11,370,335 | 11,070,926 |

[1] A considerable amount of goods that enter Mexico at Nogales find their way farther south along the coast than the confines of the State of Sonora.

Following is a summary of import values for the ports of entry within the region covered by this monograph:

| Divisions. | 1918 | | 1919 | |
|---|---|---|---|---|
| | Pesos. | Dollars. | Pesos. | Dollars. |
| Border ports | 11,370,335 | 5,685,167 | 11,070,925 | 5,535,462 |
| West Coast | 5,685,461 | 2,842,730 | 7,026,690 | 3,513,345 |
| Lower California | 3,335,902 | 1,667,951 | 2,914,698 | 1,457,349 |
| Total | 20,391,698 | 10,195,848 | 21,012,313 | 10,506,156 |

From the above table it is seen that the total imports of this commercial territory were worth more than $10,000,000 a year under very adverse conditions following several years of revolution. The resumption of mining and stock raising and the development of agriculture on anything like a normal scale will easily increase this total by 100 per cent in two years' time.

# Part 2. NORTHERN HALF OF LOWER CALIFORNIA.

## INTRODUCTION.

Isolated by its geographic position from the rest of the Republic of Mexico and long regarded by the general public as a desert waste of arid plain and rocky, waterless mountains—aside from a few more favored spots, such as Ensenada on the Pacific side, La Paz on the gulf side to the south, or the infrequent mining camps—the Peninsula of Lower California has been little known except to the few hardy miners and land pioneers of the country, or in tales of fiction dealing with "lost tribes" or dry placers.

The Imperial Valley in southern California was a desert; the Mexicali Desert on the Mexican side of the international boundary is a continuation to the south of what was formerly a waste of sand and heat, little known and uninhabited except by a few roving bands of Indians. To cross this waste from San Diego to Yuma, Ariz., was once an undertaking of danger and great labor, as water had to be carried all of the way, even for the draft and saddle live stock. The history of the Mexicali Desert has been that of the Imperial Valley. The magic of water has converted the region into one of the most productive and promising agricultural regions of the Americas to-day, and trade has followed the development of production and industry. The railway has come and with it good roads; a seaport on the gulf is to be developed; and there are now, besides the 160,000 acres under cultivation in 1922, some 240,000 acres of excellent lands available for immediate development, with water readily accessible. The total estimate of irrigable lands on the Mexican side of the line is placed by some authorities at as high as 2,000,000 acres.

Twenty-one years ago (June 20, 1901) the first irrigation ditch crossed the line and gave life to the desert. By June, 1917, 400,000 acres were being farmed in the Imperial Valley and 45,000 persons called the valley "home." The total production that year was valued at approximately $30,000,000. Up to that time no agricultural county in the United States had built up a production of $30,000,000 a year. In 1912 the value of agricultural production was between $10,000,000 and $12,000,000. In other words, the production increased threefold in five years. As has been said, the Mexicali Desert is a continuation of the Imperial Valley on the American side of the boundary. Progress and development have not stopped at the boundary line. It should be remembered that the main canal supplying water to the American side has its intake just above the international boundary near Yuma and then crosses into Mexican territory, which it traverses for a total distance of over 60 miles. Agriculture, which is developed by irrigation, calls for the highest type of cooperation. There is a consensus, among soil experts who know the region, that the soil on the Mexican side of the valley is better than that farther to the north. Its grain is coarser and it is said to take the water better.

Nowhere in the world has progress been more rapid. In 1913 there were 32,000 acres in crop on the Mexican side of the valley. By 1916 this crop acreage had been increased to 65,000, in 1917 to 80,000 acres, and in 1922 to 160,000 acres. Most of the ranchers on the Mexican side are Americans, and on every ranch all operations are carried on with the most modern implements and methods. Practically the only difference on the Mexican side is that landholdings are, on the average, much larger than on the American side of the valley. In 1919 the value of the cotton produced in the Mexican part of the valley exceeded $20,000,000 United States currency.

Besides the field crops of cotton and alfalfa, the Imperial Valley has many thousands of acres devoted to early fruits and vegetables. Asparagus, lettuce, tomatoes, peas, onions, beans, etc., go on the market first and gain for their growers the margin of extra profit of early-season high prices. Grapefruit, grapes, dates, and cantaloupes are of high quality and are rapidly increasing sources of wealth. On the Mexican side of the valley development in these highly cultivated lines has not been so far advanced and there exist great opportunities, especially in the growing of early vegetables and citrus fruits.

Commercially the northern half of Lower California can not be said to be foreign sales territory, but is in reality domestic sales territory to be handled by the southern California selling organizations.

In 1539 Cortez sent an expedition of three vessels under the command of Francisco de Uloa up the gulf from Acapulco, the Gulf of California then being supposed to be a long strait leading to the northern seas. Uloa found the mouth of the Colorado River and in 1540 the Viceroy of Mexico, Mendoza, sent the explorer Alarcón with instructions to explore the river and to operate in the interior with a land expedition under Coronado, which started at the same time from Culiacan on the West Coast of the mainland. Alarcón ascended the river for some distance in boats. It is said in history that the name "California" came from "Cali fornax" or "oven heat," the expression of Cortez when he felt the heat of the Lower California Desert. The first survey of the gulf was made in 1746 by Father Consag, early Jesuit missionaries having entered the peninsula in 1697. They found the Indians submerged in the lowest barbarity, but also encountered certain ancient remains of a former and superior civilization. The Jesuits were given possession of the peninsula as early as 1636 and held it until their proscription in 1767 by the Spanish Crown. There followed several other religious orders, all of which founded Indian missions, the ruins of which still may be seen, until Mexico secured its independence from Spain. The first exploration was ordered by Carlos I of Spain in 1522. Cortez sent the first expedition in 1524 and he followed with two ships in 1526 from Tehuantepec. The first real land exploration took place under command of Sebastian Viscaino in 1596. Esteban Carbonelli discovered the first pearl fisheries near Muleje in 1632.

Mention should also be made of the first American expeditions from the north following the discovery of gold in California and emanating from the national interest in and necessity for a western transcontinental railway. Lieut. R. S. Williamson, of the United States Topographical Engineers, commanded one of the four expedi-

tions authorized by Congress under President Pierce in 1853. Jefferson Davis was Secretary of War at the time. The object of the Williamson expedition was to find and locate a route to California by following the Sierra Nevadas of California southward, seeking a suitable pass through which a railway might be built across the mountains from the Missouri River to the Pacific Ocean. Dr. William R. Blake, geologist of this party, made the first geological survey of the country covered and of the Imperial Basin and Desert.

The discovery of the San Gorgonia Pass between the peaks of San Bernardino and San Jacinto meant a practical and easy route and made necessary the purchase of the territory in southern Arizona through what is called the Gadsden Purchase.

The first reclamation project was promoted by Dr. O. M. Wosencraft of San Francisco, Calif., between 1853 and 1859, but Congress failed to sanction the grant of 3,000,000 acres of land. In 1875 and 1876 examination of the irrigable part of the delta was made by Lieut. George M. Wheeler to determine the feasibility of irrigation. About the same time Thomas Blythe, a capitalist of San Francisco, Calif., and General Guillermo Andrade formed a partnership for the development by irrigation of the latter's enormous landholdings in Lower California. This same large landholding was subsequently taken over by General Harrison Grey Otis and his associates and became the present California & Mexican Land & Cattle Co. on the American side and the Colorado River Land Co. on the Mexican side. The acreage on the Mexican side alone totals some 835,000 acres, all subject to irrigation from the Colorado system, and approximately 150,000 acres of this area is now under cultivation.

Like the Nile, the Colorado River is a great fertilizer of the soil which it irrigates, and Mexico has received its share of the benefits accruing from the enterprise of the West which has made possible the Salt River Basin development in Arizona, the Elephant Butte Dam on the Rio Grande, and the Yaqui River project of the Yaqui River Land & Water Co., which is a similar irrigation project in Sonora south of the port of Guaymas.

About 1870 interest in placer gold was still much alive all over the West, and Lower California first came to the attention of the general public in that year, when the first gold discovery was made at Real del Castillo, located in the northwestern part of the territory. By reason of this discovery the district became the scene of considerable activity, and, while official data are lacking, it is said that one miner alone extracted $11,000 worth of gold from a small vein of rich ore. In 1880 the dry placers of Calmalli were opened. These were situated near the twenty-eighth parallel on the line dividing the north district from the south district. Here thousands of prospectors gathered, and the ground worked was of greater extent and richer than that of the original discovery at Real del Castillo. In 1889 the famous placers of Santa Clara, now called Mineral del Alamo, were found, and for a time this field was thought to rival the gold placers of the old California days of '49. Pockets worth $30,000 and even $60,000, were discovered and taken out in a short time, and the old town of Ensenada rivaled the famous mining camps of the early days of the western gold rush. It is estimated that from 1880 to date the yield of veins and placers of the North District of Lower

California has exceeded in value 30,000,000 pesos, or $15,000,000 United States gold currency.

Several small mines working gold vein deposits are still being operated, and it may be predicted that Lower California will again see activity in mining. There are known to be extensive deposits of good iron ore, magnesite, kaolin, nitrate, gypsum sand, and other commercially valuable minerals used in manufacturing and industry, the potential value of which is great and the development of which is only a question of the development of manufacturing on the Pacific coast of the United States.

In fisheries alone Lower California possesses great natural wealth, not only on the more accessible Pacific coast, but also in the Gulf of California. Recent reports of surveys made show the existence of good commercial fish in the northern part of the gulf.

Commercially, the northern half of the peninsula may be said to be domestic territory, so far as the exporters of the United States are concerned. The commercial interest is small as compared with that of agriculture and fishing, and the great opportunities lie undoubtedly in the three basic industries—agriculture, mining, and fishing. The most immediate development is, of course, that of the easily accessible and irrigated lands of the Mexicali region opposite the Imperial Valley of California.

Being isolated from the rest of Mexico and depending upon the one great source of wealth, cotton, it is a fact that never during the past 10 years of disturbed conditions in Mexico have the growers failed to make a crop or to export it freely into the United States for marketing and shipment.

## GEOGRAPHY, TOPOGRAPHY, AND CLIMATE.

### GEOGRAPHIC FEATURES.

The Peninsula of Lower California lies just south of the international boundary line between Mexico and the United States, the dividing line running almost straight west from Yuma, Ariz., to Tia Juana, a few miles south of San Diego, Calif. The head of the peninsula is about 140 miles in width and lies between 117° 15′ and 115° 15′ W. longitude, while the body extends to the southeast for a distance of approximately 800 miles. The Pacific coast line, which is a continuation of that of California, begins at 32° 30′ N. latitude and 117° 5′ W. longitude and extends south by east to Cape San Lucas, almost opposite the Mexican West Coast port of Mazatlan and just south of the Tropic of Cancer. The eastern boundary in the north is formed by the Colorado River from a point 3½ miles west of Yuma on the Colorado to the mouth of the Colorado at the northern extremity of the Gulf of California. The Peninsula of Lower California is separated from the mainland of Mexico by the Gulf of California, an arm of the Pacific Ocean having a length of 600 miles and an average width of about 100 miles. The mouth of the gulf is about 130 miles wide and its narrowest between the Islands of Tiburon and Angel de la Guardia, where it is only 35 miles (not counting the width of the Ballenas Channel). The peninsula presents an irregular shape with Point Santa Eugenia extending far out into the Pacific at 28° N. latitude and forming San Sebastian Vizcaino Bay to the north of it. Farther to the south on the Pacific side another bulge in the coast line is made by Cape San Lazaro, just south of 25° N. latitude. The peninsula gradually narrows from the American border for a distance of 240 miles and then widens abruptly at Point Santa Eugenia, where the maximum width is 160 miles. It narrows again at a distance of about 120 miles to the south, then increases to a width of approximately 100 miles at Cape San Lazaro. At La Paz Bay, on the gulf side, the peninsula is only about 30 miles wide.

South of Cape San Lazaro lies Magdalena Bay, formed by the peculiar shore formation of Cape San Lazaro to the north and the large islands, Margarita and Creciente, which lie to the southward. Magdalena Bay is famous as a good harbor and fishing ground, and in former years was the scene of maneuvers and target practice by the American Pacific Fleet.

### AREA.

The total surface area of the North District of Lower California comprises some 77,376 square kilometers, or 48,079 square miles, which is approximately one-half of the total area of the peninsula.

Generally speaking, the peninsula is rough and mountainous, with a small proportion of good lands in comparison with its total surface area. The exceptions are the irrigable region of the Mexicali Plain, containing approximately 2,000,000 acres of good soil; the wheatlands adjacent to Ensenada at Guadalupe; the San Quentin Plains;

the Magdalena Plains, lying inland from the bay of that name and south of San Quentin; a few small isolated valleys of the interior; and rough areas of pasture lands in the northwestern part.

## TOPOGRAPHY.

### SURFACE AND RELIEF.

Two irregular lines of short mountain ranges run more or less parallel to the coasts, each sending off spurs here and there which connect one line with the other. Between these spurs lie easy natural passes from the Pacific to the gulf. Such a pass leads from the port of San Felipe on the gulf, about 90 miles south of Mexicali and opposite Santo Tomas on the Pacific.

The principal watercourses are found on the Pacific slope in the northwestern part of the peninsula. These streams are all short and swift, running during the brief season of rain but usually dry or partially dry during most of the year. The largest is the Guadalupe River, which rises on the western slope of the Sierra de Juarez and flows into the Pacific just north of Ensenada.

The Pacific line of ranges is heaviest in the northwestern part as far down as Cape Santa Eugenia, where two transverse spurs connect with the gulf line of ranges. These ranges average about 4,000 feet above sea level but have peaks of 4,400 feet and even 4,900 feet, such as Three Peaks, northeast of Ensenada, and Las Animas, southeast of Ensenada. The highest range is that of San Pedro Martir, which has two peaks 10,000 feet high.

The northwestern part south of San Diego is very rough. Many high mesas or table-lands occur in the inland region south of Ensenada and west of the short but high range of San Pedro Martir. This range is in line north and south with the Sierra Juarez, which extends to the border west of Mexicali. Between the Sierra de Juarez and the rough country to the west there is a stretch of fairly level country lying between Tecate (on the international boundary line) and the main range to the east and extending into a hilly and fairly well timbered country toward the mountains. Back of Ensenada are found a number of small and fairly well watered valleys, among them being that of Guadalupe, now occupied by a colony of Russian farmers engaged in growing wheat.

The eastern slope of the Sierra Juarez is very precipitous, falling from 4,000 to 5,000 feet in 8 to 10 miles. To the east of this range is a great sink or level desert basin now partially filled by what is known as the Laguna Salada, which is 35 miles long and which is fed by the overflow waters of the Colorado (through the Hardy and Pescadero Rivers, which are really overflow mouths or channels of the Colorado) during the season of high water and backwaters of the tides in the gulf. Between the Laguna Salada and the irrigated section in the northeastern corner of the peninsula lies the well-defined and precipitous Cocopas Range, terminating at Signal Mountain near the border a few miles west of Mexicali. This range marks the western boundary of the present irrigation system of Lower California in that part which lies opposite the famous Imperial Valley of the United States. This region is the ancient fill of the delta of the Colorado River and contains some 2,000,000 acres of excellent lands subject to irrigation. These lands lie in a great triangle which extends from Yuma on the northeast to Signal Mountain on the west and down

to the end of the Cocopas Range to the south. It is said that even the Laguna Salada can be dried and cultivated and that also the lowlands along the coast to the south can be brought under the present system of water supply from the Colorado River.

### GEOLOGICAL FORMATIONS.

The entire peninsula is of volcanic origin, the mountain ranges showing numerous evidences of heavy scarifying by fire. There are large areas of burnt lime and red shales, granite outcroppings, and the usual dikes of syenites, rhyolites, and pegmatites. The granite is the oldest rock and forms the pedestal of the islands in the gulf. Only small strips of the calcareous rocks are seen and these carry numerous concretions of flint. Sandstones constitute an important formation of great thickness. Of the marls only small layers are found. Andesites and basalts are frequent in many localities. There are also several types of argillaceous formations. The geological order appears to be as follows: Granites, syenites, diabases, and pegmatites to the Paleozoic; sandstones and marls to the Triassic; tufas, andesites, and rhyolites to the Tertiary; basalts and argil banks to the Quaternary.

Deposits of diatomaceous earths, kaolins, gypsums, nitrates, sulphur, and other substances much used in manufacture, are known to exist on the peninsula. Gold, silver, copper, and iron are found, but paying ores have been discovered only in small bodies, with three or four notable exceptions. Prospecting is very difficult on account of the lack of water in the interior.

The mountain system of Lower California is a continuation of the Coast Range of the United States, which, on entering the peninsula, runs in two branches toward the south and southeast. The highest peaks in these ranges are Tecate and Picachos in the northwestern part. The Sierras of Real del Castillo, Santo Domingo, San Vicente, Santo Tomas, and Rosario form the chain that crosses the district, all of them forming part of the axis which in the southern section of the district is known as the Sierra de San Pedro Martir, the highest and largest of the entire peninsula. The other less conspicuous ranges are those running parallel to the western coast from north to south, as Mesa Redondo near Tiajuana; Sierra de Santa Rosa, Ensenada, Punta Banda, San Isidro, and their continuations following due southeast.

### VALLEYS AND PLAINS.

The mountains covering the north district form many small valleys but these are all of a very limited extent and, as a rule, have insufficient water for agriculture. The main valleys are those of Tiajuana, Descanso, Vallecitos, Las Palmas, Guadalupe, Santo Tomas, Maneadero, San Telmo, El Rosario, Ojos Negros, La Trinidad, La Hechicera, and others of less importance. By far the most extensive plains are those of Mexicali, watered by the irrigation system of the Colorado River and containing some 2,000,000 acres of level lands; the plains of San Quentin south of Ensenada and extending inland from the port of that name; and the Magdalena Plains, which extend inland from the bay of that name and which are said to contain more than 250,000 acres of good agricultural lands subject to irrigation by means of artesian wells which have been located.

The most notable canons in the north district are those of Cancio and El Burro on the road from Ensenada to Tiajuana; that of Las Cruces, from Ensenada to Real del Castillo; de la Grulla, on the road to El Alamo; and that of Los Llanos, crossed in 1917 by the new military road from Ensenada to Mexicali.

### RIVERS AND CREEKS.

The steep slope and the limited area of the drainage basins cause the streams of the north district to be short and swift in their course to the sea on the Pacific side. The Colorado River is the natural boundary that separates Lower California from the State of Sonora in Mexico and the State of Arizona in the United States. The Colorado River has several branches in Mexican territory. The Mexicali River sprang from an overflow of the Colorado; Rio Prieto comes from Laguna Prieta, or Volcano Lake, as it is also called, and is used for irrigation in the Mexicali district as well as on the American side of the dividing line; Hardy River also has its source in Volcano Lake and empties into the gulf near the old main channel of the Colorado. When the tide in the gulf is extremely high, Hardy River overflows, causing its waters to cover a large area of lowlands to the northwest of the Cocopas Range and creating a shallow salt lake called Laguna Salada, which measures 35 to 40 miles in length by 15 to 20 miles in width.

The Tiajuana River has its source in the United States, crosses the line into Mexico at Tecate, and again enters the United States at Tiajuana. The San Vicente River runs from El Alamo to San Vicente, and thence into the Pacific. The San Rafael River has its source in the San Pedro Martir Range and flows into the Pacific via San Telmo. The Santo Domingo River also has its source in the San Pedro Martir Mountains, crosses the Santo Domingo section and also San Quentin, and flows into San Ramon Bay on the Pacific. The Rosario River comes from the Rosario Mountains and empties into the Pacific. Guadalupe Creek runs north of Alamo through Real del Castillo to the Pacific; San Carlos Creek runs north of Alamo, passes through the lands around Ensenada and empties into the Maneadero Estuary; Santo Tomas Creek comes from near the old Alamo mines to Santo Tomas and the Pacific. There are a number of less important watercourses, all of which flow into the Pacific and are usually dry during the greater part of the year. There are a few water holes and springs.

### LAKES AND LAGOONS.

Laguna Salada has already been mentioned. Volcano Lake (Laguna Prieta), Laguna Mayor at Mexicali (formed by the Hardy River), and the Laguna Manuela to the south near the boundary line of the south district on the Pacific side are the principal lakes.

The Maneadero Estuary is located near Punta Banda; San Quentin Estuary is also on the Pacific coast.

The bays within the north district are generally small and of little importance, with the exception of the harbor of Ensenada. The bays on the Pacific coast are Descanso Bay, south of San Diego, California; the Bay of Todos Los Santos at Ensenada, the best and largest harbor in the north district; and the undulations of the littoral where these form the Bay of San Ramon, and farther south

the Bay of San Quentin. At the mouth of the Rosario River is the small bay of Rosario, while far to the south are found the smaller and shallow bays of Blanco, Falsa, and Playa Maria. South of the mouth of the Colorado River there are two bays, Ometepec and San Felipe, where large deposits of salt are found. This region may soon become of importance on account of the proposed railway or highway to connect the Mexicali district with tidewater.

### ISLANDS.

There are numerous islands, though generally small and uninhabited, on both sides of the peninsula included under the jurisdiction of the north district of Lower California. The best known are the Coronado Islands, south of San Diego Bay, and Todos Los Santos Island at the entrance to the Bay of Ensenada at the extreme north end of Punta Banda. These islands are very rough and have no water. Some guano is obtained from them. In Rosario Bay there are two small islands, San Geronimo and Sacramento, both without water. Offshore from these islands lies the rich island of Guadalupe, where thousands of goats are pastured. There are springs of good water but the island does not possess any good agricultural lands. The islands of San Benito and Cedros also belong to the jurisdiction of the north district. Cedros Island has deposits of sulphur and magnesite which were studied by Mexican Government experts in 1917. Montague Island, which lies in the very mouth of the Colorado River, is a low flat formation surrounded by numerous bars. Farther to the south in the gulf the islands of San Luis and Angel de la Guardia form the Ballenas Channel. Southeast of Angel de la Guardia lies Tiburon, a large island inhabited by the semisavage "Seri" Indians. These islands do not belong to the jurisdiction of the north district of Lower California, but to the State of Sonora and are used at certain seasons of the year as bases for fishing for pearls, sharks, seals, and whales. It is of interest to note that in 1917 the Mexican geologist F. Paredes made a study of these islands and also those of Monserate, Catalina, and Carmen, under the direction of the Ministeria de Fomento, to determine their prospective value as sources of petroleum, it having been rumored that seepages of petroleum had been discovered on them, and also that oil had appeared on the sea waters near by.

## CLIMATE AND RAINFALL.

### GENERAL SURVEY OF CONDITIONS.

The Mexicali Valley lies somewhat below sea level and is affected by the same climatic conditions that affect the desert areas of California and Arizona. The land is very hot in summer, and the humidity is increasing on account of the increasing use of water for irrigation. On the mesas of 3,000 feet or more above sea level, there is found a cool semimountain climate similar to that of certain regions of California, although light frosts occur in the winter. Unlike the mainland of the West Coast of Mexico, where the mean annual rainfall increases from about 7 inches in the Sonora Desert and Yaqui Valley to about 42 inches in the region of Mazatlan opposite the end of the peninsula, Lower California is uniformly dry with the exception of the upper reaches of the ranges on the Pacific side. In that section

cloud banks form during the spring and fall equinoxes, and in August, at which times precipitation is somewhat increased. The Pacific littoral is subject to the influence of the prevailing winds and the effect of the Japan Current which strikes the coast from the north between Cedros Island and Cape San Lucas.

The region around Ensenada has a climate like that of San Diego, Calif., although the mean annual rainfall is slightly less at Ensenada than at San Diego. In the northwestern part of the peninsula the climate is not excessively hot except in the small and inclosed valleys of the interior or along the international line farther to the east, where desert conditions prevail.

### CLIMATE AND RAINFALL OF THE IRRIGATION DISTRICT.

Before irrigation was developed, the Imperial Valley and its continuation on the Mexican side was a desert. At times, periods of 13 months passed without rain. The soil was not lacking in native fertility, as the formation is that of the ancient bed of the sea filled in by the alluvial deposits of the Colorado River. Irrigation has furnished the needed water to render the region productive.

The following table shows the total annual rainfall from 1912 to 1920. There is little variation in the averages for 1921 and 1922. The same totals can be used for the total precipitation during the crop season of the year.

| Years. | Total annual rainfall. | Mean annual temperature. | Years. | Total annual rainfall. | Mean annual temperature. |
|---|---|---|---|---|---|
| | *Inches.* | ° *F.* | | *Inches.* | ° *F.* |
| 1912 | 2.40 | 70.0 | 1917 | 1.68 | 71.0 |
| 1913 | 1.92 | 69.9 | 1918 | 1.80 | 70.9 |
| 1914 | 2.88 | 71.6 | 1919 | 2.88 | 70.0 |
| 1915 | 2.76 | 71.2 | 1920 | 4.92 | 70.1 |
| 1916 | 4.44 | 71.1 | | | |

The lowest temperature recorded for any year was 18° F. Protected from the cold north winds by hills or ranges, there are several favored spots which are frostless and particularly desirable for citrus fruit growing. Windbreaks of trees have been found very useful not only as a protection from low temperatures, but also as a protection for young plants, especially fruit trees, from the sand drifted by the winds in the hottest time of the year.

The season of high average temperature is expected in June and lasts until fall. The season of lower average temperature is expected in the months of December and January.

The heaviest precipitation always occurs in August. A fall of 2.75 inches, almost the total for the year, has been noted in a single 12 hours during this month. Light rains are usual in January and February.

In the fall and spring the prevailing winds are from the west. Their maximum velocity is about 30 miles per hour. Windstorms of

sufficient velocity to damage buildings or crops are unknown in this section.

While the summer temperature of the valley is high, the heat is not, as a rule, felt nearly so much as a temperature of 90° F. in the more humid atmosphere of the middle western or the eastern part of the United States, although, as has been said, the moisture content in the irrigated section of the valley is increasing. A temperature of 100° F. means less in the Imperial Valley than one of 86° F. in Chicago, New York, or Philadelphia. As a rule, no work is done in the fields during the middle of the day through the crop season, except in cases of emergency.

Tropical weight clothing is worn in the summer. In the business district of Calexico and Mexicali, El Centro, and other valley towns, the buildings are designed to cover the sidewalks, the second story extending out to the curb line. The nights, even in the height of the hot season of the year, are comfortable after 10 o'clock.

It has been demonstrated that the Anglo-Saxon can stand excessively hot climates if there are no tropical diseases prevalent and if he can be provided with his usual form of diet. In fact, with proper food, the white races seem to withstand high temperatures better than the usual native populations are able to do. In the valley there is no effect of anemia noticeable in the white population, which appears to be quite normal as to health in general and able to do heavy labor in the fields.

Concerning housing methods and facilities, it was noticed that wood is much used for dwelling construction, and the low-roofed type of California bungalow is much in evidence. Mexican adobe or the new type of hollow tile carried up to higher ceilings would seem to be much more suitable for this climate, and if wooden roofs were used, these could be air spaced. In this climate the small frame house is unbearable during the middle of the day in the hot time of the year. Some means of heating has to be provided for the winter months. Small single-room electric heaters have been found to be quite adequate for all purposes and are much used.

With the provision of some means of shade, live stock of all kinds does very well in the open.

### CLIMATE OF THE ENSENADA AND PACIFIC COAST REGION.

The climate of the Pacific littoral of the peninsula is unequaled anywhere, winter or summer. The temperature ranges from 75° in summer to 50° F. in midwinter, and there is practically no rainfall between the months of May and November. Last season 18 inches were recorded as the average throughout the coast region. The annual average precipitation at Ensenada is 10.1 inches, with about 20 inches for the country inland from the port on the higher elevations of the mountains. Ninety per cent of the rainfall occurs between November and May. The mean humidity is 75 per cent. The prevailing winds are from the northwest, with their velocity greatest in May and lowest in December. The average summer temperature is 68° and the average winter temperatue 60° F. The

variation in temperature is shown by the following figures taken from the records at Ensenada:

| Months. | Minimum temperature. | Maximum temperature. | Average. |
|---|---|---|---|
| | °F. | °F. | °F. |
| January | 50.0 | 62.4 | 56.2 |
| February | 51.1 | 62.3 | 56.7 |
| March | 52.8 | 63.3 | 58.0 |
| April | 54.8 | 65.6 | 55.0 |
| May | 58.6 | 68.2 | 63.4 |
| June | 62.5 | 71.6 | 67.0 |
| July | 65.5 | 74.2 | 68.8 |
| August | 67.0 | 75.7 | 71.3 |
| September | 63.7 | 74.5 | 69.1 |
| October | 64.7 | 74.5 | 69.6 |
| November | 54.5 | 67.8 | 61.1 |
| December | 52.0 | 64.7 | 58.3 |

The mountain ranges farther inland carry considerable snow in the winter.

Ensenada, with its good bay, excellent fishing and bathing, wonderful climate, and back country of mountains, has few rivals as a resort for both winter and summer, but the lack of good hotel accommodations, the lack of automobile roads from the border and to the mountains, and the competition of California (which provides all facilities for the tourist traffic both summer and winter) lessen the attractions of Ensenada. However, the new motor highway from Tia Juana to Ensenada is now being repaired after having been washed out in several places during the winter rains, and it is to be expected that Ensenada will make a bid for its share of the traffic.

## POPULATION.

The population of the entire peninsula is about 25,000. The north district contains about one-half of this number, averaging 1 inhabitant to an area of 6 square kilometers. The bulk of this population in the northern half of the peninsula is found in the three principal towns, Mexicali, Ensenada, and Tiajuana. Mexicali district is credited with having 6,500 people, Ensenada district 4,250, and Tecate 550. The population of Tiajuana is included in that of the district of Ensenada. The town of the latter name contains about 1,800 people. The preceding figures include the municipal districts, or counties, and include the smaller towns of Santo Tomas, San Telmo, Santo Domingo, San Quentin, and El Rosario.

The aboriginal inhabitants of the region are the Guaycures, Cucapahs, and Yuma Indians, few in number and living far removed from contact with the towns of the country. In addition to their own dialects these tribes speak Spanish to some extent.

During the cotton planting and picking seasons, Mexicali becomes the center and headquarters for a large floating population, several thousand workers coming from the interior of Mexico and the fruit districts of California.

### NATIVE AND FOREIGN POPULATION.

While the bulk of the inhabitants is composed of native Mexicans, there are many foreigners in the north district, principally at Mexicali. Several hundred Americans are employed on the various ranches as engineers, automobile, tractor, and truck drivers, expert mechanics, etc., also as executives and as agricultural experts.

The largest foreign population is Chinese. It is estimated by the Chinese Association that there was a total of 3,500 Chinese in the north district of Lower California in 1922, of which at least 3,000 were located in the Mexicali region and were engaged in cotton planting or in commerce allied with the cotton industry. The Pacific port of Ensenada has 50 to 100 Chinese, and Tiajuana is credited with about the same number. The Chinese population of the district in 1918 and 1919 was estimated at 5,000, but this number has been depleted by the slump in the cotton market since the fall of 1920. Numbers of Chinese have drifted away to other parts of Mexico and a few of them have made their way into the United States. With the return of more normal prices for the principal product of the district, these men are rapidly returning and it is expected that soon the region of Mexicali will again have a Chinese population of 5,000.

The principal employment of these people is on the large cotton farms, either under contract with the American growers as free laborers or on a share basis with wealthy Chinese lessors of cotton lands. The bulk of the cotton crop (in 1922 the area planted was estimated at 160,000 acres) is put in and harvested by these people.

Mexicali, Tiajuana, and Ensenada all have small foreign populations. On account of the better housing and living conditions and the better school facilities on the American side, many Mexicans of the better class who have their offices and business on the Mexican side reside on the American side of the line in Calexico, opposite Mexicali, the two towns being divided only by a street and railway tracks.

There is a small Russian colony of about 60 families located at Guadalupe, near Ensenada, and engaged principally in growing wheat.

There are about 25 Americans scattered throughout the district among the small mining camps and ranches to the east and south of Ensenada and on the gulf to the east and south of Mexicali.

## EFFORTS AT COLONIZATION.

Several attempts have been made to colonize the lands of Lower California outside of the valley in the Mexicali region. The principal effort was made by a Canadian and British company in the San Quentin region, where a large area of level land is available; and an American company is now engaged in an effort to colonize the lands of the Magdalena Plains adjacent to Magdalena Bay, far to the south and outside the political division of the north district.

With the exception of the Russian colony at Guadalupe and the lands east of Mexicali under direction of the new Mexican Government agrarian measures, these efforts have not been successful, perhaps on account of the general lack of water and the expense attached to its provision by means of storage dams and artesian wells. The Pacific coast of the United States continues to absorb the surplus of agricultural immigration in spite of the rising value of lands available for settlement.

## RACIAL CHARACTERISTICS.

While the bulk of the native Mexican population is composed of the peon element, with the exception of those coming in now from the interior of Mexico to work in the cotton fields, most of the men cross freely into the United States where they follow railway work, construction work, seasonal agricultural employment, etc., and become further advanced than their compatriots of the interior of Mexico. They wear better clothing, and increase their standard of living in general. On the Mexican side of the valley they are employed as ranch foremen, irrigation watermen, teamsters, general farm hands, etc. They become very skillful in ditch construction and are credited with being quite as dependable on the whole as any of the modern class of floating agricultural laborers.

The chief advantage in the use of the Chinese laborers was their system of organization among themselves, enabling them to undertake large work under contract with one central head. The Chinese of the district work together under their own organizations, and, except over the counters of their small stores in the towns, have very little contact with the native population. They have formed their own association for mutual understanding and protection in business, marketing, labor, etc., and are closely affiliated with the Chinese of San Francisco, Los Angeles, and elsewhere. They are noted for their

faithful compliance with their contract terms, and they constitute a powerful element of the Mexicali Valley.

As has been said, many Mexicans of the better class reside on the American side, and the Mexican population of California has increased to such an extent during recent years that it may be said that in the northern part of Lower California and Sonora the influence is almost entirely American—certainly commercially, and, to a great extent, socially as well. This is still further true of the immediate Mexicali region, where development has been almost entirely American, although, on account of the new Mexican land laws and agrarian measures, there has been an increasing number of small independent Mexican farmers during the last two years. Although the Mexicali part of the irrigated region is a continuation of the Imperial Valley of California, conditions of development are different, inasmuch as the lands on the Mexican side are held in most part by owners of large tracts, and undertakings are on a large scale, with little individual effort in small holdings, as is the rule on the American side of the valley. Since 1917 the Mexican land laws have not been favorable to the development of agriculture in small individual farms by foreigners; and it is a question of time and education before the average Mexican farmer can take land, even in small holdings in an irrigated section like that of Mexicali, and compete with his neighbor to the north. This class of Mexicans, unfortunately, seems to lack the initiative, the spirit of energy and organization, and the persistent application necessary for such development under existing conditions.

## GOVERNMENT AND EDUCATION.

### POLITICAL ORGANIZATION.

The peninsula of Lower California is a Mexican Federal Territory divided into two districts, the north district and the south district, the dividing line running across the peninsula just north of Cape Santa Eugenia and the twenty-eighth parallel. The two divisions are about equal in area and population. Ensenada was formerly the capital of the north district, but for political and military reasons Mexicali was made the capital by Governor Cantu during the Carranza régime in Mexico, Mexicali having become a center of greater importance.

Mexicali municipality includes the numerous agricultural centers which have sprung up to the south and east of the town, the Tecate section, and that of Algodones. The municipality of Ensenada includes Tiajuana, Real del Castillo, El Alamo, Santo Tomas, San Telmo, San Quentin, Rosario, and Galmalli.

The capital of the south district is La Paz. The governors of the respective districts are appointed by the Federal Executive, who, in turn, appoints the "jefe politico" of each subdivision, while under the new political regulations in Mexico the municipal presidents are elected by popular vote.

### EDUCATIONAL MATTERS.

During the past two years the north district of Lower California has had 35 primary schools, one of which is exclusively for girls, one for boys, and the remainder for both sexes. There are no private schools, and all schools are sustained by the government of the district. The total number of pupils is 2,600, of a total enumeration of 2,693 children between 5 and 14 years of age, representing, with the exception of 93 children enumerated in the school census, all of the children of primary school age in the district—a record for Mexico and many Latin American countries. One hundred and three teachers are employed. These teachers are assisted and supervised by four traveling school inspectors.

The district is now spending an annual sum of 818,355 pesos ($409,177.50 United States currency), or 314.75 pesos per pupil. A great deal of the credit for this new impulse toward popular education is due to Governor Cantu, who also had constructed the new and modern high-school building at Mexicali, a model of its kind and well worthy of a much larger and richer community. For higher education pupils have to rely on the private or public schools of the United States or travel to the interior of Mexico, where, in Guadalajara and Mexico City, there are many students from all over the Republic.

### BUDGET AND PUBLIC IMPROVEMENTS.

According to the treasury accounts of 1921, the movement of funds from revenues and expenditures reached approximately 1,500,000 pesos ($750,000 United States currency). At the time of

the reception of Governor Lugo in February, 1922, there appeared 82,000 pesos on hand, which was not enough to cover the accounts due. Since then, without allowing gambling, revenue has not been less than 150,000 pesos per month, sufficient to allow the new Government to complete the new Government palace, keep up the road work in the cultivated sections of the valley, carry out waterworks improvements, do paving in Tiajuana, and even afford pecuniary assistance to small farmers. There is now a surplus of 200,000 pesos on hand, and even the close of the racing season in Tiajuana did not greatly affect current revenue.

The new Government palace at Mexicali was started by General Cantu with a sum of 105,000 pesos appropriated for the purpose. During the term of Governor Balarezo, an additional 50,000 pesos was appropriated for this palace, the total cost of which is not known. Recently $26,000 was appropriated to furnish the lighting, plumbing, and other fixtures of the building, which is a reinforced-concrete structure, modern in every way.

Plans have been made for sewer construction in Mexicali, the work also to include improvements of the water supply. Streets have already been laid out for a large town. The work of laying the sewer pipes is well under way and paving will follow. The municipality (county) of Mexicali keeps up the dirt roads in the irrigation district as far to the south as Cerro Prieto (Black Butte) and east halfway to Yuma along the railway.

Plans for the future include permanent buildings in Mexicali for the customs, municipal government, irrigation, and colonization service, and Ensenada plans to rebuild the old pier, now in a state of partial decay. Tiajuana receives a comparatively large revenue from racing, gambling, saloons, and other concessions, and is rapidly carrying out paving and other improvements.

In all of this work native contractors are preferred, but, on account of the proximity, American materials, fixtures, etc., are used exclusively. Sufficient native skilled labor is available, as many Mexicans have worked at trades in the United States and have become fairly good mechanics.

## SURVEY OF INDUSTRIES.

In the northern half of Lower California the leading industries, in order of their importance, are agriculture, fishing, and mining. A small amount of grape wine is manufactured near Ensenada, and there is a small plant for fruit packing at the same port. Two fish-packing plants are located farther south on the coast. There are also four small flour mills, three at Ensenada and one at Tecate, and some cotton gins at Mexicali. Each of the three more important towns has a small ice plant and an electric light plant.

Forest products are limited to pine lumber coming into Ensenada from the near-by mountains for local building purposes, and to "orchilla" dye moss. The collection of the latter was once an important industry and is now regaining its importance on account of a renewed market demand. This industry does not properly belong to the north district, as the best-known fields for its collection lie on the Pacific coast south of the dividing line between the two districts. Magdalena Bay is the principal port of export shipment. This dye material went formerly to San Francisco for reexport to England, which is again bidding for new supplies.

The greatest and most immediate opportunity in industry lies in fish canning and curing. Plants have been established on both the Pacific and gulf coasts, but little progress has been made in face of the difficulties of disturbed political conditions, lack of sufficient capital, and general scarcity of native labor supply. The interior of Mexico is a large and increasing consumer of American and European canned and cured fish, and, with the heavy import duty, a medium-sized cannery ought to prove an excellent investment, even though conditions so far do not seem to have worked out to this end.

An enterprising Japanese and one American and Mexican firm have small plants on the Pacific side of the peninsula. The main difficulties seem to be competition from American packers, lack of capital sufficient to bring production up to a competitive marketing basis, and present general overproduction and world market conditions. The fish are there, climatic conditions are ideal, and it is probably only a question of time until the large companies will develop the field, now that the old exclusive fishing concessions of the Diaz Government have been canceled and the field opened freely by means of a system of individual permits, and the recent Mexican export duty on fish removed.

There are also opportunities in mining, especially in the production of industrial minerals, such as kaolin, magnesite, gypsum, iron ore, etc.

The Mexicali region offers great opportunities in agriculture. Good land subject to irrigation costs from $160 to $250 an acre on the American side of the valley. The same class of soil located approximately the same distance from town and railway can be had on the Mexican side for a third of this valuation, or less, while conditions of water, climate, labor, transportation, etc., are exactly the same. The question of property titles has never come up in this section, and even during the years of political disturbances in Mexico the growers on the Mexican side have never failed to raise a crop and export it to market in the United States without hindrance. One concern alone has invested nearly a million dollars in a 10,000-acre cotton tract, and smaller planters are being attracted from Texas and elsewhere.

## AGRICULTURE.

### AGRICULTURAL DISTRICTS.

The northern half of Lower California contains four agricultural districts: The Mexicali Valley, a part of the Colorado delta and a continuation of the Imperial Valley of California; San Quentin Valley, on the Pacific coast to the south of Ensenada, containing some 70,000 hectares (172,970 acres), at present undeveloped, but of potential value with the development of irrigation by means of storage dams and wells; and two smaller valleys, Las Palmas and Valle Redondo, located between Ensenada and Tiajuana.

Farther south on the Pacific coast and extending inland from Magdalena Bay are the Magdalena Plains, also of potential value for development by irrigation from wells and storage dams. Mention should also be made of the wheat lands of Guadalupe, near Ensenada, now being farmed by the Russian colonists. The San Quentin Valley, in reality a large alluvial plain, was the scene of an attempt at colonization by a British and Canadian company, but development is not active at present.

### MEXICALI VALLEY.

The Mexicali Valley is a part of the Colorado delta lying in Mexican territory, and is also a part of the great Salton Sink. The Colorado River runs for a distance of some 90 miles south of Yuma, Ariz., through Mexican territory before emptying into the Gulf of California.

For the purpose of this report, it is sufficient to state that on account of the formation of the land lying immediately west of Yuma on the western side of the Colorado River it was found necessary, in following the contour of the land, to carry the main supply canals from the intake just above the international boundary in the United States down into Mexican territory to a point west of Calexico, the longest main-supply canal, running for an approximate distance of 65 miles in Mexico. Other branch canals take the water into American territory east of Calexico. The main canals of the irrigation district include 9.6 miles in the United States and 132.6 miles in Mexico, with waste canals totaling 8.1 miles. Flood-protection levees total 70 miles of heavy border work, and this does not include the previous work done by the original water company and the Southern Pacific Co. for the flood protection of the valley. The above totals do not include the mileage of the canals and ditches of the mutual water companies.

The Mexicali district may be said to be divided into two sections. The first of these forms a great triangle with its base to the north along the international boundary line from Yuma to just west of Calexico, a distance of 62 miles, with its eastern line formed by the Colorado River, and its western line that of the Cocopah Range. This area is the present scene of development. The other section is the sink lying west of the Cocopah Range, now partly covered by the Laguna Salada. The lands along the border immediately west of Yuma are slightly higher than the main canal levels and therefore have to be supplied with water by means of electrical pumps, power for which comes from the Yuma station.

### SOIL FORMATION.

The entire district is part of the great alluvial fill of the Colorado and may be compared to the Nile region. The waters of the river constantly bring down silt and humus, forming a rich deposit on the surface. Textures encountered may be described as follows: Soft silt composed principally of leaf matter and decomposed woods; sand and silt in almost equal proportions; silt mixed with clay in varying proportions; medium hard sand; hard clayey soil, which apparently washes only under concentrated flow of water, and which seems to seal with a slippery surface; exceptionally hard sand, which evidently changes into quicksand when encountered below the surface.

Clay deposits underlie the entire district, as is shown by numerous outcroppings. The clay formation becomes the foundation for the other formations. It is the consensus of opinion among experts who know the valley well that the soil on the Mexican side is better than that on the American side, as it takes the water better, is of somewhat coarser texture, and hence works more easily under the plow.

### HISTORICAL NOTES ON IRRIGATION.

It has been previously noted that the first effort toward the development of the valley by means of irrigation was promoted in the years 1853–1859 by Dr. O. M. Wosencraft of San Francisco, Calif., but Congress failed to grant the 3,000,000 acres asked for at the time. Again in 1875 and 1876 Lieut. George M. Wheeler carried out a survey of the region for the United States Government to determine its practical value as an irrigation and reclamation project. About the same time Thomas Blythe, a capitalist of San Francisco, Calif., and Gen. Guillermo Andrade formed a partnership for the development by irrigation of the latter's immense landholdings on the Mexican side. The Andrade property was afterwards taken over by Gen. Harrison Grey Otis and associates, who formed the California-Mexican Land & Cattle Co. and later the present Colorado River Land Co. (Colorado River Land Co., S. A., in Mexico), which owns a total of 835,000 acres of the best land in the Mexicali district.

In 1900 the California Development Co. was formed. The leaders were C. R. Rockwood, engineer and promotor, George E. Heber, General Chaffee, and others, and active work was started to put water on the land, the work beginning at a point on the Colorado River just west of Yuma, Ariz. The years 1905 and 1906 brought exceptionally heavy summer floods. The original channel silted up, and the river cut a short new channel on the Mexican side; and a portion of the stream diverted itself by forming a new channel and flowing west and north into the Salton Sink far to the northwest in American territory. The British-owned salt springs and mines in the Salton Sink were covered with the water, and the Southern Pacific main line between Los Angeles and Yuma had to be moved several times to higher ground. It should be remembered that the Salton Sink is over 200 feet below sea level and that therefore the flood waters cut through to the west and north instead of following the old main channel of the river, which flows due south into the head of the Gulf of California. The conditions caused by these floods called for heavy flood protection and channel diversion works which the company was not prepared to undertake on account of lack of sufficient capital. The company called on President Roosevelt, who

turned the work over to the Southern Pacific Co., which also controlled large landholdings in the district and was interested in the promotion of its development. The Southern Pacific engineers, working with the Government engineering experts, were successful in turning the river back, and in 1915 the entire irrigation system was taken over by what is known as the irrigation district, organized as a political unit for public benefit, all qualified voters being part of the organization and passing on matters coming up just as in municipal, county, or State elections.

The California Development Co. went into receivership at the time that the work was taken over by the Southern Pacific Co. The latter undertook to satisfy the damage claim of the British company owning the salt springs in the Salton Sink. The irrigation district issued bonds to the amount of $7,500,000, of which the Southern Pacific Co. holds $3,500,000 as reimbursement for its share of the investment. The present total investment is $8,500,000, and a new bond issue is being proposed by the district to take over the intermediate water companies in order that the entire system may be operated as a unit. There are 15 mutual water companies which take the water from the main supply canals of the district and distribute it to the various landowners who are subscribers to the mutual companies. This is on the American side of the line. In Mexican territory of the district the company operates under the name of the Compañia de Terrenos y Aguas de la Baja California, and landowners or lessors take their water from the main supply canals in their own ditches constructed for their individual accounts. The original California Development Co. operated under a concession from the Diaz Government, the terms of which included the clause that lands on the Mexican side were entitled to one-half of all of the water passing through Mexican territory to the United States. The question of the division of water from the river is again coming up in connection with the proposed Boulder Dam farther up the river, plans for which are well under way, with Mexican officials and engineers cooperating. In this same connection there is the project of the all-American main canal from Yuma to the Imperial Valley on the American side, a project long agitated, which will be made possible by the higher levels of intake to be provided by the Boulder Dam.

#### IMPROVEMENTS AND DRAINAGE.

The Mexicali Valley being a continuation of the Imperial Valley on the Mexican side of the line, it is inseparably involved in any development affecting the entire region under irrigation. The Boulder Dam project has for its principal object flood control of the Colorado; but great areas of new agricultural lands will become available with water in California, Arizona, Colorado, and New Mexico, and there is also the great consideration of hydroelectric power development to be taken into account. Flood control and drainage measures to prevent damage by the water-logging of the lands are also important to the valley on the Mexican side.

A new bond issue of $7,500,000 is before the voters of the Imperial Valley in accordance with the provisions of the California Irrigation District Act, for the purpose of taking over the intermediate water companies (mutual companies) by the purchase of their canals, ditches, machinery, and equipment. The total value placed on the

improvements of the mutual companies is an average of $10 per acre irrigated for a total of 446,525 acres, or $4,465,250, with an additional inventory value of equipment placed at a total of $534,750 for the 15 mutual companies, the total purchase estimate being $5,000,000. By such purchase all irrigation on the American side would be handled direct by the district.

Reports by experts show that there is also an urgent need for drainage provision for the reclamation and protection of the lands of the valley from becoming water-logged by the rising of subsurface water. It is estimated that at present there are some 50,000 acres so affected and that for the assessed valuation of property for 1921, as compared with 1920, the difference in valuation was approximately $4,000,000, or 9.1 per cent. Certain portions of the district need drainage works to lower the level of the ground water, and present surveys are being carried out to determine the depth of this ground water over the entire district. It is estimated that for the drainage of lands already affected by the rising ground water or in danger from water-logging and for prevention in the future, a total of $2,500,000 is necessary, and this sum is included in the new bond issue proposed to the voters.

As at present organized, the mutual companies take the water from the main supply canals of the district, paying 85 cents per acre-foot. Each landowner holds as many shares of stock in his mutual company as he has acres. Stockholders are assessed for the expense of cleaning canals and ditches and for payment for water. Assessments are levied on a pro rata basis, idle lands not using water being exempt from payments.

On the Mexican side of the valley the cost of leveling, constructing main canals, ditching, putting in water gates, etc., may be estimated at an average cost of $10 per acre for large tracts of land.

### ACREAGE ON MEXICAN SIDE OF VALLEY.

The great triangle of the Mexicali Valley contains something over 1,000,000 acres, of which it is estimated that there are approximately 200,000 acres available for irrigation, including the Laguna Salada west of the Cocopah Range. There were 160,000 acres under cultivation and water in the summer crop season of 1922. The total number of acres irrigated on the Mexican side in 1921 was 121,604. The irrigated area showed a decrease from 136,560 acres in 1919 and 188,716 acres in 1920 during the cotton boom.

The first water crossed the line in canals June 20, 1901. In 1908 there was a total of 6,935 acres irrigated and planted on the Mexican side and this total rapidly increased year by year until the figures given above were reached. With flood control of the river an accomplished fact, assuring sufficient water at all times, there is practically no limit to the possibilities of development in agriculture on the Mexican side of the great valley. The total number of irrigable acres on the American side is placed at 506,000 under the present system. In 1921 the total irrigated was 410,070 and the total placed for 1922 was 446,525 acres. Irrigated acreage on the American side increased from 141,030 in 1906 to the high figure of 414,440 in 1920. These totals do not include the Holtville district.

### IRRIGATION DATA: WATER, WEATHER, AND CROP FIGURES.

Taking the calendar year 1920 as a basis, the reports of the irrigation district show a total of 603,440 acres irrigated during the year, of which 188,716 acres were in Mexico. The total quantity of water diverted for direct use during the year was 3,097,957 acre-feet. The total quantity wasted was 772,576 acre-feet and the amount lost 230,092 acre-feet. The total quantity of water delivered to the mutual water companies was 2,095,289 acre-feet. The amount of water delivered to the mutual companies was 0.10 acre-feet in January, 0.54 in July, and decreased to 0.14 in December.

Cotton constitutes by far the largest acreage on the Mexican side of the valley and the highest consumption of water is during the cotton planting and first growing season from May to August, the peak of water consumption coming in July. Fortunately, June is the season of highest water in the river, so that the flood season coincides with that of a greater water consumption. With the development of agriculture and a corresponding increase in water consumption, this is an important point to remember. The total average consumption per year is 3.47 acre-feet, the highest record being 4.12 acre-feet in 1914. The rainfall during the planting and growing season averages between 0.14 inch and 0.41 inch, the latter being the record in 1920.

### PERCENTAGES OF CROPS.

Although on the Mexican side cotton is grown to a far greater extent than any other crop, there are now considerable acreages devoted to alfalfa, wheat, and fruit. On the American side, in 1920, cereals and seed made up 20.6 per cent of the acreage, which had diminished for these crops from a percentage of 47.9 in 1912. Cotton on the American side totaled only 3.3 per cent in 1912 and increased to 49.2 in 1920. Alfalfa and forage crops decreased on the American side from 44 per cent in 1912 to only 16.9 in 1920. Fruits and vegetables (lettuce and cantaloupes) increased on the American side from 4.8 per cent in 1912 to 13.3 per cent in 1920.

### VALUE OF CROPS AND PRODUCTION.

The total estimated value of the agricultural products of the valley in 1912 was between $10,000,000 and $12,000,000. In 1917 the total value was estimated at $30,000,000, production having trebled in five years. In 1915, 32,000 acres were in crop on the Mexican side, and the acreage was increased to 65,000 in 1917. In 1912 the acreage devoted to cotton on the American side was 8,000. In 1917 the total cotton acreage of the valley had been increased to 70,000, with 50,000 on the Mexican side. The crop values on the Mexican side are about in direct proportion to the acreage planted. The industry is greatly favored on the Mexican side by the lower cost of the original land, the investment therefore being much less. In fact, the same class of land with the same relative location costs one-third less than on the American side of the line.

## COTTON PLANTING.

### OUTLINE OF DEVELOPMENT.

The first cotton was grown on the Mexican side in 1910 when a small amount was raised. Production increased in 1911-12 when prices averaged $0.17 per pound. The cotton crop of 1919 totaled 125,000

acres, with an estimated 132,000 acres planted in the 1922 season. Peak prices were obtained in 1919 for the 1918 crop, when as high as $0.58 a pound was received for the shorter lengths of staple and as high as $1 per pound for the long-staple Durango cotton. Prices ran between $0.18 and $0.22 for what was left of the 1921 crop, the best price paid being $0.23½ in May.

The world cotton production in 1910 was estimated at 19,992,780 bales. The average annual yield is about 21,000,000 bales. All world estimates for this year show a probable total yield of only 15,000,000 bales.

The prospect for an increase in price for cotton has greatly encouraged the growers. The cost of production of the 1920–21 crop delivered in January, 1921, was about $0.25 per pound, wages and other expenses being still much inflated all along the line of production, while prices dropped to as low as $0.08 per pound. The 1921 crop paid off the losses of the 1920 crop. Wages have now been forced back to normal and the consensus of opinion among the growers is that they can make money if the production cost is held down to $0.13 to $0.15 per pound delivered in bale, the return depending upon the location of the land, the class of soil, and methods and seed used.

The boll weevil has not as yet made its appearance in the valley, climatic conditions do not affect the growing of the staple in any way, and water is to be had just at the right times during the season.

A new seed has also been developed by the United States Department of Agriculture at the experimental station located at Mellowland near El Centro, 13 miles from Calexico and Mexicali. The seed of this variety, called "Acala," was first tried out on the Mexican side in 1921 and produced nearly twice as much per acre as ordinary cotton. Production had been about 6,500 bales for every 8,500 acres of cotton land, and with this new seed a production of 1⅕ bales per acre is expected. The staple of the new product is much better, also. Not enough seed of this kind could be secured by the planters this year for all of the acreage desired.

### GRADES OF COTTON.

The valley got its cotton reputation by its unusually bright white cotton, the bulk of which goes to Japan, where the buyers want a high grade of cotton, but pay no attention to staple. The Continent gives more attention to staple than to grade; grade counts for 25 per cent in price, while the length of the staple counts for 75 per cent. Three or four years ago the valley produced mostly Durango long-staple cotton, the fiber running from $1\frac{3}{16}$ inches to $1\frac{5}{16}$ inches in length. The bulk of the cotton this year will be Lone Star, which runs $1\frac{1}{16}$ to $1\frac{1}{8}$ staple, and Acala, which gives a good $1\frac{1}{8}$-inch Liverpool staple. The estimated yield for 1922 is at least 100,000 bales from the Mexican side of the valley. The grades are as follows, according to Liverpool standards: Strict good middling, good middling, strict middling, middling, low middling, strict good ordinary, and good ordinary.

The United States Department of Agriculture maintains an experimental station near El Centro in the valley and also a branch office at Calexico. Strict seed and plant inspection is enforced, and growers on the Mexican side receive the same benefit from this service as those on the American side.

METHODS OF PLANTING.

The delta lands are level, but need to be graded for irrigation. The first work is that of ditching, which costs on an average $10 per acre. Before the land is handled for water it has to be cleared of the brush—principally mesquite, which in places is of very heavy growth. On the Mexican side of the valley the average cost of clearing is about $45 per acre; in many places this cost includes the work of leveling. The highest average cost for clearing and leveling has been $60 per acre. The mesquite is unusually heavy and has to be grubbed and pulled. For this work tractors are used to a great extent. The soil is left perfectly clean and free of roots and other hindrances to plows and implements.

After the ditching has been done, the land is plowed with disks, listed, then irrigated, after which a harrow is passed over it to top the ridges of the furrows. The land is planted by means of two and four row drills. The rows are cultivated by plows and the cotton is "chopped" once or twice as the need may be.

WAGES.

The 1922 scale of wages for various classes of labor is as follows: Carpenters, $6 per day; tractor men, $5 per day and board; teamsters, $2 per day; choppers, $1.50 per day (under contract, $1 per acre). Irrigation water men get $2 per day and feed themselves; foremen are paid $150 per month besides their board and lodging.

LABOR CONDITIONS.

The Chinese have raised 80 per cent of the cotton grown on the Mexican side of the valley and their system of operation is as follows: One Chinese with money of his own, or capital which he controls, gets a lease from the company owning the land and forms a cooperative company with an average of 16 men to the 1,000 acres of cotton land. The land may be raw and may have to be cleared, leveled, and ditched, or it may be developed land, the price paid per acre per season varying accordingly.

The men of the company contribute small sums varying from a few hundred dollars to a thousand or more dollars toward the enterprise. They also work for a share in the crop. Wages are not paid during the working season and only food and clothing are advanced to the men during the crop and picking season. In this manner each person is interested in the success of the crop and has an individual stake in the venture. The plan makes the initial investment very low as regards cash outlay, and the Chinese thereby require less financing than the other ranchers for their crop season.

For their mutual protection the Chinese of the valley have formed an association with headquarters in their own building at Mexicali where hospital facilities are also provided for the men. The Chinese merchants, many of whom are also cotton planters on a large scale, belong to this association, which makes negotiation with the Chinese easy and practical at all times. The association maintains an American representative and is in close touch with other Chinese interests in the United States, principally in San Francisco, Calif. The total

number of Chinese in the valley on the Mexican side of the line in 1919 was 5,000, in round numbers, is now 3,500, and is increasing. The men are returning because of the attraction of better prices for cotton.

The Chinese have been able to finance heavily from among their own people in San Francisco in the past, but this source of capital was hard hit by the drop in the rice market in the fall of 1920 and their principal need at present is a new and sure source of capital with which to finance their planting operations. Their cotton is all marketed in the United States through the usual channels and they purchase their equipment and the bulk of their supplies, with the exception of certain foods, in the United States. Such items of food as rice, dried fish of certain kinds, and special edibles dear to the Chinese palate come from Hongkong, the gross amount of such imports being calculated at about $250,000 a year. Cheap hats for work in the fields, sandals, and some textiles and dishes used also come from China.

In view of the preceding, the only benefits not contributing to American trade in general may be said to be the small proportion of their wages sent out of the country by the Chinese.

### LANDHOLDINGS AND METHODS OF DEVELOPMENT.

By far the largest landholdings on the Mexican side are those of the Colorado River Land Co. with a total area of 832,000 acres, reaching from the Cocopas Range to the gulf and as far north as the line of the railway and to the border west of Calexico. This enormous property is the old Andrade estate, which was purchased by the California-Mexican Land & Cattle Co., and which is being developed by far-seeing and energetic California capitalists.

The second largest holding is that of the Southern Pacific Co., whose lands lie north of the railway (Inter-California Railway) and reach to the boundary line for a distance of about 46 kilometers (28.5 miles) west of Yuma, Ariz. The original tract totalled 22,336 hectares, or 55,192 acres, but to date 11,176 hectares, or 27,615 acres, have been sold to farmers under the plan of the company to dispose of the lands at very reasonable terms to promote their active development in agriculture. The eastern half of these lands is not subject to gravity irrigation, lying too high to take the water from the present canals, and electrically driven pumps are being used to elevate the water from the main supply canals to the level of the land. The western half is subject to gravity irrigation under the present system.

The lands are held in Mexico under the name of the Compañia de Terrenos y Aguas, S. A., to comply with the new agrarian regulations of Mexico which require that all lands be held by Mexicans or Mexican companies. Even small owners are forced to hold their titles under the name of a Mexican company.

Prices of these lands run from $35 to $40 (United States currency) or a little more per acre, according to class of soil, location, etc. Similar lands on the American side of the valley are selling for $160 to $200 per acre.

The company has had considerable trouble with squatters recently. Small tracts of some of the best lands in the western part of the section have been taken by natives, presumably under the new agrarian provisions of Mexico, and, although court orders have been

obtained under existing Mexican laws, the authorities have not acted for their actual ejection. It is estimated that in the entire Mexican side of the valley there are not over 120 native Mexicans engaged in agriculture for their own account.

The railway company maintains a land office in Mexicali, which is actively engaged in selling off the remainder of these lands to settlers.

On account of the large profits being made in the valley from early vegetables, fruits, fodder, and cotton, a very considerable number of newcomers are being attracted, especially farmers from Texas, who understand cotton growing and the handling of native Mexican labor.

The next largest landholding in the valley on the Mexican side is that of the now famous Cudahy ranch, purchased some years ago by G. C. Cudahy of Chicago, and located at Hechicera Station on the Inter-California Railway about halfway between Calexico and Yuma. The tract contains 16,000 acres in a square block, and over one-half of it is now under cultivation. The property produced 4,300 acres of Durango long-staple cotton in 1917 and employs 400 men in the crop season. Special attention is being given to stock, and the Duroc-Jersey hogs produced are the pride of the country.

There are in the valley on the Mexican side about 60,000 acres located principally west of Calexico. This land is held by small colonists who are engaged in cotton planting, with about 10,000 acres in cotton in 1922.

#### DEVELOPMENT POLICY OF COLORADO RIVER LAND CO.

The Colorado River Land Co. owns the old Andrade estate totaling 832,000 acres. This year there are about 125,000 acres in cotton, 10,000 acres in alfalfa (which can be cut from 6 to 8 times a year), 160 acres in lettuce and vegetables for export, and 3,800 acres in wheat. The experiment with lettuce for export was very successful. A profit of $1,100 per acre has been realized in many cases on account of the early production and the exceptionally fine quality. The experiment in wheat was also very successful, the yield being large and samples of the grain running A1. An experiment in Chinese hemp is being carried out. One hundred acres have been planted and the estimated yield is from 1,500 to 2,000 pounds per acre, averaging in price 15 cents per pound. In anticipation of the coming crop of hemp, $10,000 has been invested in decorticating machinery. The success of this experiment will mean a new and large industry for the valley and it is thought that many acres of lands not well adapted to other crops can soon be devoted to hemp.

It has been said that 80 per cent of the cotton crop of the valley on the Mexican side has been produced by the Chinese planters. The Colorado River Land Co. was the pioneer in this means of development. The Chinese were used on account of the lack of other available labor supply and also because other features of Chinese organization methods made it possible to develop large areas at a minimum expense.

It is not the policy of this great company to sell lands now, but to develop the raw land by a sytem of leasing whereby such areas are gradually put into first-class condition. As development of the region advances, the lands will be worth a great deal more than at present valuations.

According to the class of soil, location, and condition of development, tracts of land are leased to planters, at a varying scale of rental, running from 15 to 25 per cent of the crop delivered at gin or warehouse, or from $1 to $10 an acre per year. Undeveloped land is charged for at the rate of $1 per acre for the first year, then $2.50, $5, $7.50, and $10, according to the condition of the lands leased. Land which has to be cleared, stumped, and ditched is charged for at the rate of $1 per acre for the first year. All leases carry an overhead charge of $1.30 per acre per year to cover taxes and other assessments.

Water for irrigation is taken from the main supply canals of the irrigation district at the rate of $0.85 per acre-foot.

Several groups of California capitalists have been attracted by the exceptional advantages offered for development on a large scale in cotton planting on the lands of the Colorado River Land Co. and have leased large tracts. The largest of these is known as the Shenk lease and totals over 12,000 acres, of which 10,000 acres are in cotton this year. This block is situated in the southern part of the present developed district of Mexicali near the landmark of the Black Butte, or Cerro Prieto, about 30 miles southeast of Mexicali. The tract presents a remarkable spectacle of 10,000 acres of perfectly level land all in cotton, ditched, and with roads between the sections leading to the various divisional camps of the workmen and superintendents. The tract was leased in 1921, when 3,000 acres of land were releveled and 8,500 acres of cotton planted which produced 6,421 bales of clean cotton. A check was given recently for over $536,000 for a part of this crop in one sale, at a price of well over $0.20 per pound.

Over $800,000 has been expended in the development of this tract, exclusive of planting the crops. The value of the equipment, camps, etc., is placed at $300,000 and the money spent on the 1922 crop of 10,000 acres of cotton is placed at $200,000, exclusive of the picking at the end of the season.

Some of the mesquite clearing on this land was exceptionally heavy and cost, on an average, $60 per acre. The average cost of the waterworks was $10 per acre, including main intake ditches, water gates, structures, etc. To give some idea of the magnitude of this undertaking it may be stated that this tract of 10,000 acres of cotton under irrigation has 22 miles of main water intake canals, carrying 500 acre-feet of water, or more, and 68 miles of delivery ditches.

In connection with the proposed Boulder Dam project, which will provide flood control for the entire irrigated region on both sides of the line, it can be said here that flooding of this tract alone or diversion of the water supply would cause actual damage between $500,000 and $1,000,000 United States currency. With 160,000 acres under crop on the Mexican side this year and with a potential acreage of over 1,000,000 acres of land available for irrigation and production, the importance of the project to American interests on the Mexican side can not be overestimated.

As has been noted, the policy of the company is to develop its holdings by this system of leasing until large bodies of land have been put into first-class condition ready to crop, when they will be sold to small colonists at $50 to $150 per acre, depending upon location, class of soil, and other conditions.

From the standpoint of the small farm investor, there is a great advantage in the first cost of the land on the Mexican side. Relative locations, so far as transportation and commercial centers are concerned, are practically the same as on the American side of the line. Market conditions are the same, and the same fruit express service and other transportation facilities are provided by the Inter-California line of the Southern Pacific Co. all along the northern portion of the region. Even during the past 10 years of disturbed conditions in Mexico, growers have never failed to harvest their crops and freely move them to the American side for market disposal without excessive taxation or other interference. All agricultural equipment is imported into Mexican territory free of duty at a very small charge for customs brokers' services, etc., and general supplies in small quantities are allowed to pass the border freely when not intended for resale or merchandising enterprises. Seed for planting carries no duty.

An additional advantage on the Mexican side is the fact that first delivery is secured on the water supply, which crosses Mexican territory before reaching the lands on the American side; and it is conceded that in general the soil on the Mexican side is better.

### AGRICULTURAL IMPLEMENTS AND MACHINERY.

#### IMPORT DUTY.

All agricultural equipment and machinery is imported duty free into Mexico. There is a small customs brokerage charge for clearing shipments through customs. The shipping point for clearing is Mexicali, although such shipments can cross the line by rail at the border station of Andrade, near Yuma, if coming from the southwest.

#### PLOWS AND HARROWS.

The plow most used for cotton is the 26-inch disk in sets of two for mules and in six and four gang for tractors, six being used in the lead and four in the rear, and cutting a 100-inch swath. The John Deere heavy-duty plow of this type was most seen and is preferred by the larger planters. A listing plow of 24 and 26 inch size is used for putting the soil into rows for planting on top with drills. These are for mule traction. A one-mule sweep plow is also used for cleaning between the rows after planting. Plowing is done to an average depth of 6 to 8 inches. Heavy-duty equipment is always advisable for tractor traction. The spiked-tooth harrow is used, hooked behind the plows, with tractor traction.

A new form of cultivator which is being used consists of a double or quadruple row of close-set small thick disks having serrated edges like a gear with sharp edges. This is passed over the land after disking when it is dry enough to break up the clods. This machine breaks up the clods, pulverizing the surface soil and making a much better seed bed.

#### IMPLEMENTS AND TOOLS.

The principal implements used are the long-handled, round-pointed shovel for ditch work and watering, and the broad, heavy hoe for "chopping" the cotton during the first part of the growing season.

### TRACTORS.

Many types both large and small are used, but for work on a large scale the 60-horsepower machine having the long track is much preferred, as the track runs the entire length of the machine and rides over and across the tops of the rows.

A new and special type of cultivator tractor was seen, having the motor ahead under an automobile type of hood. This tractor was mounted on a high chassis carrying exceptionally wide axles and having wide-tread steel wheels which compass two rows. Cultivation is effected by means of ordinary wide cultivator shares carried down from a frame extension in the rear of the motor. The operator's seat is mounted in the back and the machine is furnished with a long rod to the steering wheel (the guide being forward) and with ready hand levers for the adjustment of the cultivator shares.

Mules do very well in the soft irrigated soil, stand the heat better than any other draft animals, need less care than horses, and can be fed cheaply, as alfalfa is grown on the ranches for the purpose; but tractors of the type mentioned are much preferred, as they can be worked day and night during the short season of scarcely 90 days between picking and the new planting. Tractors can also be used for the scraper work in ditching.

### AGRICULTURAL INSURANCE.

Ranchers on the Mexican side have only recently been able to obtain the usual flood, hail, rain, wind, and fire insurance from the companies specializing in agricultural insurance. However, this additional advantage is now obtainable freely under the same conditions as on the American side.

The irrigation district maintains a system of telephone lines, and flood prevention equipment is maintained at various stations.

### FINANCING CROPS—BANKING.

The banking laws of the State of California do not permit national banks in the State to loan money on security located in a foreign country. For the last five or six years nearly all of the financing in the Mexicali region in connection with cotton planting has been done by the Globe Cotton Oil Mills (Inc.), a subsidiary of the Globe Grain & Milling Co., the business being conducted in Mexico through an agent. This company was the first to erect cotton gins at Mexicali to take care of the crop grown on the Mexican side of the valley.

During the cotton boom in the war period costs became excessive. Prices ranged from $0.56 to $1 per pound, and costs of actual production reached $0.25 per pound, and even more. As in other industries during this period, excessive expansion occurred and credits were overextended on all sides. When the sudden slump in the cotton market took place in 1920, heavy losses were sustained and the Globe company was forced to take over large quantities of equipment and low-priced cotton in payment of advances on the crop being marketed that year.

The financing of the crop in 1922 was done by private capital, and the Colorado River Land Co. took care of its own lessors in the way of necessary advances on the crop, consistent with the work accomplished, market prices to be expected, and other factors. A

careful supervision is being maintained whereby overextension of credit is checked in time.

The two banks of Calexico—the Calexico Bank and the Central Bank of the Imperial Valley—in connection with interested California capital have organized a branch on the Mexican side at Mexicali under the name of the Mercantile Banking Co., S. A., for the purpose of taking care of banking and credit needs of the growers in the Mexicali region this year. One of the largest cotton concerns of the South also is represented in the same manner by a resident agent, and several smaller private concerns have been formed for cotton financing and planting under the leasing system.

### CREDIT CONSIDERATIONS WITH RESPECT TO CHINESE PLANTERS.

It has been explained how the Chinese are growing 80 per cent of the cotton on the Mexican side of the valley under their peculiar plan of cooperative work in the form of a mutual company in which one Chinese with backing secures the lease from the owners of the land and then organizes a mutual cooperative company among his fellows. The Chinese need less in the way of advances of cash, as no wages are paid during the season and all men working get their share at the end of the picking and delivery season. Only food and clothing are advanced and this end of the business is taken care of by the Chinese merchants of Mexicali, who are very often owners of the leases as well.

The Chinese were able to get some money from their countrymen in San Francisco, Calif., up until the heavy losses sustained in the rice market failure in the fall of 1920. Their need now is additional capital, for which they will pay handsome bonuses and heavy interest. While the Chinese are considered first-class credit risks from the moral standpoint, their tendency is to overdraw on their credit during the season. No unused portion of a loan is ever returned, it either being used later during the season or sent out of the country; but the Chinese involved will most certainly pay back the full amount received sooner or later. As an example, there is one authentic case where a Chinese leaseholder paid off the losses on his 1920 crop with his 1921 crop, clearing up a total indebtedness of $595,000 without any difficulty when given the time to do so. In other words, he worked all of 1921 to pay back what he owed and had lost in the market slump in cotton in 1920.

Business with the Chinese is easily handled through their head men, and in conducting their business on the American side relating to land or money interests they much prefer to deal with one man whom they know and trust. The Chinese planter is an excellent risk when strict supervision is carried out over his needs in accordance with his work, market conditions, etc. Through their association representatives the Chinese are now making a strong bid for additional credit facilities in California, but investigation seems to point to the fact that their present facilities are adequate, particularly as the principal landowners leasing them their cotton lands each year are much interested in their progress and success and have been instrumental in the protection of their interests. Confidence is being rapidly restored by the management of the company under this policy, and the financial strength back of the interests owning the lands is entirely adequate for all demands for a long time to come.

### LABOR NOTES.

As laborers in the fields the Mexicans are preferred by the independent owners and lessors. It is claimed that the Chinese are poor workmen when it comes to heavy work. Raw land leased and worked by them is often found in poor condition and has to be releveled for proper watering, and the clearing and stumping is not carried out in a thorough manner. In other words, the work of the Chinese on the land, when attempted on a large scale, is less effectual than that of the Mexicans. The advantage with the Chinese is their talent for organization among themselves and their competence in carrying out contracts and leases.

### COTTON GINS AND COMPRESSES.

There are four companies engaged in this phase of the cotton business. The Globe Cotton Oil Mills Co. has one 5-stand gin on the Mexican side (having recently lost two units by fire), and ten 5-stand gins on the American side which could be used also. The Goorey-Hartman Gin Co. has one 5-stand gin on the Mexican side at Mexicali and two of the same capacity on the American side. The Chinese-Mexican Gin Co. has four 5-stand gins in Mexicali. The Colorado River Land Co. is erecting several 5-stand gins on the American side this year. The Calexico Compress Co. has a large compress of sufficient capacity for the field and handles the product. The cost of ginning averages about $7.45 per bale.

### COTTON SEASONS.

The cotton planting season lasts from March until late in May, if there is a warm spring, although the seed can be planted as late as June. The picking starts in the latter part of August and lasts until the first of the following March. The month of September is the height of the picking season. The cotton ripens early but it is usually too hot to do much picking in August. The first shipments of ginned cotton are made during the latter part of September. It takes from one to two pickings to clean fields. The yield is very even on account of the combination of heat and irrigation. Experiments have been made with a new cotton-picking machine, and it is thought that with certain changes the machine will work well in the valley.

### COTTON EXPORTS FROM MEXICALI DISTRICT TO UNITED STATES.

To give some idea of the extent and value of the cotton industry in this region the following figures taken from the import statistics of the United States customs service are given. In the calendar year 1920 exports of short-staple cotton from Mexicali through the border port of Calexico were 35,604,827 pounds, valued at $9,359,827. In 1921 the figure was 35,707,797 pounds, and the declared value $5,681,836. Long-staple cotton exported for 1920 was given as 13,000 pounds, valued at $7,800, and in 1921 a total of 36,359 pounds, valued at $14,286, were sent over to the American side.

The United States emergency tariff act of May, 1921, placed an import duty of $0.06 and then $0.07 per pound on long-staple cotton coming into the United States, "long staple" being applied to a length of fiber of 1⅛ inches or over. It was pointed out that previously shipments of cotton from the Mexican side were declared as

long and short staple, but that now only short staple was declared. It was argued in the valley that this emergency tariff was primarily devised for the protection of the cotton growers of the South and that the Imperial Valley would be harmed by the strict application of the regulation to that section also.

Imports of short-staple cotton seed into the United States through the port of Calexico during 1920 totaled 69,891,454 pounds, valued at $1,154,361. In the calendar year 1921 the amount was 77,943,176 pounds, valued at $515,996. Seed of long-staple varieties imported through Calexico in 1920 amounted to 25,000 pounds, valued at $588, and in 1921 none was declared, so far as the records show.

Imports of cotton linters in the calendar year 1920 were 6,000 pounds, valued at $2,906, with none recorded for 1921.

In the calendar year 1920 imports of cottonseed cake amounted to 906,951 pounds, valued at $14,582; and in 1921, to 81,804 pounds, valued at $1,636.

Cottonseed oil imported from the Mexicali side in 1920 totaled 157,196 pounds, valued at $21,082; and in 1921, 51,000 pounds, valued at $2,816. Hulls imported in 1920 amounted to 1,142,300 pounds, valued at $3,390, and in 1921 a total of only 25,000 pounds were declared, valued at $447. The oil mill shut down in June of 1921.

### OTHER AGRICULTURAL EXPORTS OF MEXICALI DISTRICT.

In the calendar year 1921 Mexicali exported to the United States a total of 35,186 bushels of milo maize, valued at $30,898. This was the first export of this product for the region. The soil of the district is very good for milo maize and the nonsaccharine sorghums, owing to the absence of rainfall.

### EXPORTS OF LIVE STOCK.

In 1920, 2,808 head of sheep, valued at $31,811, were sent into the United States through Mexicali; in 1921 only 322 head, valued at $3,340, were sent over. During the first half of 1922, 3,901 head of sheep and lambs, valued at $27,527, had been exported to the United States through Mexicali. A few head of beef cattle were also exported during these periods. All other exports from the Mexicali region to the United States amounted to only $182,192 in 1920 and $79,853 in 1921.

The Mexicali consular district includes the territory from Yuma to the Pacific beyond Tiajuana and takes in the border ports of entry of Mexicali, Tiajuana, Tecate, and Andrade. The line of division between this consular district and that of Ensenada extends from the Pacific point of the boundary line down to the mouth of the Colorado River.

## ENSENADA DISTRICT.

The hilly and mountainous surface of the Ensenada district limits agriculture to a few small valleys in which a variety of products are grown. The climate in these valleys is like that of southern California.

Wheat was formerly raised in the Tiajuana and Tecate Valleys and one 25-barrel capacity flour mill is still located at the latter place, although the grain is no longer planted to any extent.

At times during the disturbances in Mexico, which were reflected at Ensenada, local taxation and petty interferences militated against

maximum production, but these conditions have long since disappeared.

Santo Tomas is famous for its grape wines. A very good grade of both red and white table wine is produced, the annual production of which is estimated at 200,000 gallons. This wine sells at an average price of 6 pesos (approximately $3 United States currency) per gallon. The Santo Tomas section also produces dried peaches, apricots, figs, quinces, and some fruit pastes. The largest plantations of olives exist here, having been introduced by the old mission fathers. Olive production is not sufficient for exportation.

San Telmo has the advantage of large springs of water sufficient for some irrigation and enough corn, beans, and other products are raised for local consumption and for shipment on a small scale to Ensenada. The dried pears of this section are famous throughout the peninsula.

On account of the watershed formation from the Sierra de San Pedro Martir, there is an opportunity here for irrigation on a much larger scale by means of retention dams for storage.

Santo Domingo is in a state of partial abandonment at the present time, although a flourishing mission existed here in colonial times. At an elevation of 2,500 to 2,700 meters back on the slopes of the San Pedro Martir Range there are several large natural lakes where pasturage is good during the year. In this section good sport is offered in hunting the wild goats and mountain sheep and fishing for mountain trout in the creeks.

Situated on the coast not far south of Ensenada and possessing a small harbor, San Quentin lies at the coast edge of a large plain, the scene of the scheme of the Lower California Development Co. to colonize the region. A 3-foot gauge railway 16.7 miles long was constructed along the coast to San Ramon; a flour mill, the largest on the peninsula, was installed; and plans were evolved for utilizing the water coming down from the San Pedro Martir Range for extensive irrigation. The work was interrupted by the conditions during the revolutions in Mexico, and the company is at present inactive.

Since then, at San Ramon, the Mexican Agrarian Commission has established an agricultural colony near the Santo Domingo Creek, where some water is accessible for irrigation. The colony receives no financial aid from the Government and is slowly progressing, as a ready market is found for all products. The distance from this colony to San Quentin proper is 32 kilometers (19.88 miles).

The mission of Rosario was established by the Dominicans in 1774, and sufficient water is carried by the arroyo for the sustenance of a town of about 450 people. Farther up the stream there is a small colony of Yaqui Indians engaged in agriculture on a small scale.

South of Rosario, which lies south of San Quentin, are found the ruins of various other colonial missions. At San Xavier a few Indians, said to be the vestiges of the Cochimies tribe, are still found.

The Secretaria de Agricultura y Fomento has recently published an agrarian map of Mexico on which are shown the national lands held by the Federal Government, lands of doubtful ownership, and "baldios," or unclaimed lands of the Republic. This map also carries an isothermal scale for the entire country, and has been carefully compiled under direction of the Agrarian Commission engaged in carrying out the land allotment provisions of the constitution of 1917.

The population of the district is too small to allow of more development in agriculture. Many projects have been forwarded for the colonization of the San Quentin Valley and of the Magdalena Plains, which lie adjacent and inland from Magdalena Bay. As has been said, the effort at colonization of the British-Canadian company at San Quentin failed and the title to the lands is now under dispute with the Mexican Government in connection with the new Mexican agrarian laws.

### MAGDALENA BAY COLONIZATION SCHEME.

The Magdalena Plains constitute the only other level stretch of good agricultural lands of any size on the Pacific coast of Lower California; and, while belonging to the jurisdiction of the south district, mention of this project is made here because the ownership is invested in San Diego interests.

Under the Diaz administration of Mexico, for many years the larger part of the area of the peninsula was covered by land grants from the Federal Government of Mexico, ostensibly for colonization purposes. One company held nearly 12,000,000 acres at one time. During the last half century all attempts at colonization failed with the exception of that of the Russians at Guadalupe, previously mentioned. This small colony began with only 20 families and had increased to 45 families in 1906, and to 60 families in 1920.

The property now owned by the Magdalena Bay Improvement Co. of San Diego, Calif., was originally a grant similar to the old Diaz land grants, but the title has been recently confirmed by the Obregon Government of Mexico on March 22, 1921, after having been confiscated by the Carranza Government on April 12, 1917.

Under the new agreement with the present Government of Mexico the company ceded a zone 5 kilometers (3.1 miles) wide around the shores of Magdalena Bay in order that the bay might be under direct control of the Government; and, while the Government confirmed the title to the property, it stipulated that all lands not colonized within the time specified were to be returned to the Government. At the same time the Government conceded the fact that high land taxes had always been paid by the owners and again accepted these tax payments, but reduced them by one-half. The assessed valuation of the property was placed at 3,466,893 pesos (1 peso equals $0.50 at par). According to the terms of the new agreement the company has a period of 5 years in which to make a complete survey of the property, and an additional 15 years in all in which to colonize the holding in blocks of 5,000 hectares (1 hectare equals 2.47 acres) at a time.

The holdings of this company extend along the Pacific coast of the peninsula from latitude 23° 30′ to 29° N., a distance of about 500 miles, and extend inland for a depth of 6 leagues (1 league equals 2.7637 miles) from extreme high-water mark on the beach. The total area involved is about 5,000,000 acres, of which it is estimated that about 3,000,000 acres are arable, with over 250,000 acres of excellent land immediately adjacent to the shores of Magdalena Bay and harbor. The remainder of 2,000,000 acres is foothill and mesa land. A shallow inland waterway navigable for vessels of an 8-foot draft reaches from Magdalena Bay along the coast to the north for a distance of 135 miles with numerous good landings.

These lands are judged to be equal to the best lands of southern California, and underground veins of fresh water have been located at a depth of 14 to 50 feet in many areas. Water for irrigation can also be developed by means of storage dams. The company also owns 10,000 acres of land on Margarita Island in Magdalena Bay and on this tract are found large deposits of high-grade magnesite. Magdalena Bay is 17 miles long and 12 miles wide, with an area of about 100 square miles of good anchorage in which the depth of water varies from 5 to 54 fathoms. This bay is one of the best fishing grounds on the Pacific Ocean.

Minerals found on the property are gold, magnesite, onyx, phosphates, salt, and gypsum sands of high quality. The magnesite runs 99.36 per cent pure carbonate of magnesium, with only .21 per cent of ferric oxide, and 0.43 per cent of carbonate of lime.

Another indigenous product is the candelilla, a plant well known in Mexico as a producer of a high-grade vegetable wax much used in the arts and as an ingredient in making phonograph records, for electrical insulation material, etc., because of its high melting point.

Improvements already on the property amount to $100,000 United States currency, in buildings, landings, wells, fences, etc.

### UNCULTIVATED VEGETABLE PRODUCTS.

Orchilla is the native name in Lower California, and also the trade name, for a moss or lichen from which a valuable vegetable dye is extracted. The dye is used for coloring woolens, feathers, silks, and the more delicate textiles, and also for coloring matter in confectionery where the pure-food regulations do not allow the use of certain chemical substances for coloring. Orchilla (or archil) is also found in the Hawaiian Islands and in certain parts of the coasts of Africa. In Lower California it is most prolific in the southern part of the peninsula. The moss clings to growth of cacti and scrub vegetation of the semidesert. From 1878 to 1889 the strip of land 6 leagues wide lying inland from the Pacific coast north and south of Magdalena Bay produced orchilla to the net value of $1,559,425, or an annual income of $129,952. The moss is gathered by hand, then packed in pressed bales. These bales are covered with burlap and shipped from Magdalena Bay principally to Liverpool via San Francisco.

The industry was destroyed by the introduction of aniline dyes, but the tendency seems now to go back to the use of certain of the vegetable dyes. The prices formerly received averaged $150 per ton; recent offers are for $44 per ton.

As the existing supply renews itself every few years and is completely restored in a period not exceeding five years, the supply may be considered a permanent one. The product is also exported in smaller quantities from La Paz and San Jose del Cabo, two southern ports of the peninsula.

Caravonica, or tree cotton, is another product which is perennial in Lower California and from which large returns could be expected with the provision of water for irrigation on the San Quentin and Magdalena Plains. The plants were first introduced into Mexico from Australia in 1906. Experiments have also been carried out with this product in the Rio Grande Valley near Matamoras. It

is said that this tree cotton, so called, is obtained by crossing the coarse Peruvian cotton with the Mexican cotton.

Plants of the agave (henequen) are indigenous in the peninsula. There are no plantations.

### FRUITS.

Grapes, the citrus fruits, melons, figs, dates, and olives do well in this climate when water for irrigation is provided. The climate is particularly well adapted to date culture, and this region could be made to produce dates as fine as the best varieties of Egypt and Persia. Dried figs and dates have been sent for many years from the gulf coast of the peninsula to the mainland of Mexico.

### LIVE STOCK.

On account of the general scarcity of water and rainfall, cattle raising can not be said to be a flourishing industry of Lower California. It is estimated that there are some 25,000 head of beef stock in the northern half of the peninsula. The industry is best developed on the high mesas and slopes of the higher ranges, where conditions of water and pasturage are better. By far the largest herds are owned by a few American ranchers.

Cattle have received considerable attention by native ranchers in the southern portion of the peninsula, where the country is less broken by high and rough mountain ranges and where there is generally more moisture for pasturage. However, judging from the history of the industry in this region, the condition seems to be that large herds are built up during a period of a few good years, only to be wiped out by a series of bad years. It is very doubtful whether the provision of sufficient drinking water for the cattle would remedy this condition, as the chief difficulty is the lack of sufficient good pasturage during the protracted dry seasons.

The wild burros have become so numerous as to be considered a nuisance in many regions. Sheep have diminished. From 1885 to 1905 it was estimated that there was a total of over 30,000 head of these animals in the North District, and the wool was sold to the woolen mill at Ensenada, where it was woven into shawls and woolen clothes. This mill employed 105 hands, but has been closed down for some years on account of the lack of sufficient wool supply.

In the Mexicali Valley there exists a good opportunity in stock farming with high-bred herds fed by alfalfa and other forage crops grown on fenced land under irrigation. Land is still cheap, and good alfalfa lands can be leased for a reasonable sum per year on long-term leases or purchased for $50 or less per acre. The yield from such lands is very high. The Imperial Valley on the American side produces large quantities of dairy products, estimated at second place in the State of California. Two crops of forage and from six to nine cuttings of alfalfa can be obtained each year and pasturage is available all the year round.

Large herds of wild goats exist on Guadalupe Island, lying off the Pacific coast, and these animals were exported to the United States under a Federal Government concession during the war. These herds have been the prey of poachers from time to time. The island is very rugged and possesses no good agricultural lands, but has springs of good water. A small military guard against poaching is maintained by the present Government.

## FISHING.

### POTENTIALITIES OF INDUSTRY.

The potential importance of the fishing industry of Lower California, both on the gulf and Pacific coasts, can not be overestimated. The waters teem with marine life, and reports show that runs of edible fish in the headwaters of the gulf are as heavy as anywhere in the world.

The kinds of commercial fish found include the corbina, croaker, flounder, sea bass, halibut, silver sea trout, jack smelt, English mackerel, Spanish mackerel, barracuda, turtle, shrimp of the prawn species (usually considered too large for the American market), lobster, and three varieties of tuna called albacore, yellowtail, and bonito. The shellfish are represented by the abalone and clam, both of which are found on the Pacific side in commercial quantities. Sardines should also be mentioned, as these are second in importance in the total fish pack each year. These small fish run practically the year round and are fished and canned principally from September to June.

The coastal currents, shallow banks, warm waters, runs of the tides, and favorable climate make conditions ideal for the industry.

About June 1 the albacore start to run, a little later the bonito, and the yellowtail tuna follows, running some years until late in November and keeping the canneries in San Diego and San Pedro in full blast with the pack.

The bulk of the fish used in the canneries are caught in Mexican waters, while, with two exceptions, all of the canneries are located at San Diego and San Pedro, Calif. In 1919 the San Diego canneries packed 250,000 full cases of tuna, 150,000 cases of sardines, and 15,000 cases of turtle.

### SAN DIEGO CANNERY FLEET AND PLANT.

The growth of the industry in San Diego has developed a fleet of fishing boats, which during the summer season of 1918 numbered about 200. These craft are all powered with distillate-burning motors (No. 1 engine distillate, Baumé 31°) of the heavy-duty type and range from 5 to 60 brake horsepower in size. Taking an average of four men to each boat, 800 men may be said to constitute the number of the crew whose products go to the canneries. About 95 per cent of the boats and their crews are under contract to the canneries for their catch and often are also financed by some of the cannery plants for the necessary supplies and equipment. The Japanese make up 50 per cent of the crews, 30 per cent are Italians, 10 per cent are Portuguese, and 10 per cent are Americans. From 1,200 to 1,400 people, 80 per cent of whom are women, are employed in the canneries during the season.

Sardines are packed in olive oil, deviled tomato sauce, and peach kernel oil. Cottonseed oil is used for the tuna and albacore. Sizes of the sardine pack are known to the trade as "quarters," "halves," "ovals," and "half-rounds."

There are at present 10 canneries operating, and new leases on ground have been taken for two more. Boats are furnished by the San Diego Marine Construction Co. and by enterprising Italian and Portuguese builders.

### FRESH-FISH INDUSTRY.

There are about 100 Italians engaged in the fresh-fish industry. Twenty-five per cent of the catch goes to the local market of San Diego and San Pedro; that sent to the former point goes to Camp Kearny, United States Marine Barracks, and Fort Rosecrans at San Diego, and the rest is sent inland as far as Chicago, Kansas City, etc. The fish are packed in iced boxes weighing from 50 to 150 pounds each for express shipment. The classes of fish sent fresh are halibut, rock cod, sea bass, yellowtail mackerel, whitefish, spiny lobsters (large crawfish), and barracuda.

### FISHING METHODS.

Except for tuna, trammel nets, drift nets, and set lines are used for fishing. The purse seine, as used in Alaskan and Puget Sound waters for salmon, is beginning to be used, but objection has been made to it by the Mexican authorities in control of fishing in Mexican waters, it being alleged that this type of seine destroys the small fish as well. Clams, abalone, and the flesh of the green domed-back sea turtle are canned. The abalone is also cured for shipment to Japan and China. Mackerel, sea bass, barracuda, and other varieties of fish are dried, salted, and cured for shipment, principally to China and Japan, which countries offer a very good market. An oversize sardine, 14 to 16 inches in length, which formerly went to the reduction plants to be turned into oil, fish meal, and fertilizer, is now being cured and smoked, put up in brine and also salted. All by-products formerly wasted are now being utilized in some manner, an example of such conservation being the making of glue.

The annual catch of sardines is from 10,000,000 to 12,000,000 pounds. About 1,000,000 pounds of the spiny lobsters are brought each year from Mexican waters for consumption in the United States.

### PRICES.

In 1916 the average price paid by the canneries for fish was 2 cents per pound for all kinds of fish used by the plants during the entire season. During the first half of 1917 war conditions greatly affected the market and prices went up to 2½ cents per pound, and during the last half of that year to 5 cents per pound. In 1918 from 7½ to 8½ cents was paid as an average price to the fishermen.

Cannery prices paid last season were $130 per ton for white-meat tuna; $75 per ton for bluefin tuna, and $40 per ton for striped tuna. This year the price for albacore, the first fish to run in June, was placed at $125 per ton delivered at the plants.

There are 18 wholesale fish concerns in San Diego engaged in the fresh fish trade, and 9 Mexican importers and shippers of lobsters. The 1921 catch of lobsters was estimated at 16,051 tons, all from Mexican waters.

The first cannery was built at San Diego in 1911. The investment was around $10,000 and the pack that year was 5,000 cases of tuna. In 1920, 14 canneries were running and the total investment had in-

creased to $2,500,000. These plants are served by a total of 150 boats, valued at $750,000, and the total annual pack can be estimated at 256,000 cases of fish. All plants are modern and use the latest sanitary equipment, machinery, and methods.

The catch was 16,090 tons in 1917 and 16,051 tons in 1921, showing the even run of the fish year by year and the reliability of the seasons.

Cannery interests of San Pedro and San Diego have recently combined and the industry promises to become larger and better organized as time goes on.

Cannery interests of San Francisco have been studying the field for some years and two years ago made an exhaustive survey of the waters of the Gulf of California. The boats used were equipped with spring attachments on special types of drag nets with which the catch could be readily calculated from on board and the fish then released. The results of the expedition were surprising in the quantity and quality of fish discovered. The predominating fish was found to be the mullet, which runs up the gulf and into the Colorado River for spawning each season, beginning in June.

## CANNING PLANTS IN LOWER CALIFORNIA.

The Mexican Industrial Development Co. (Japanese), of San Diego, maintains two fish curing and drying plants, one at Magdalena Bay and the other at Turtle Bay farther to the north on the Pacific coast of the peninsula. This company is also the agent for the Peninsular United Industries Co., a Japanese cooperative society financed from Los Angeles and vicinity. A wholesale plant for handling fresh fish is maintained in San Diego, the principal business of which is the shipping of fresh Mexican lobsters to points in the interior of the United States. The chief product of the drying plants in Lower California is abalone.

The Lower California Commercial & Industrial Co. maintains a small canning plant in Lower California which is now being moved from Punta Ceniza (at San Quentin) to Cedros Island. The daily capacity of this plant is from 150 to 200 cases of fish, lobster, and abalone. Dried abalone for export to the Orient is also prepared.

While operating under ideal conditions, both concerns appear to be handicapped by the lack of sufficient capital and by the general market condition for export so that they have been unable to increase production to a point where they could hope to compete with the large canning concerns.

## GENERAL FISHING STATISTICS.

According to official records imports of fish from Mexican waters into the port of San Diego for the calendar years 1919 and 1920 were as follows:

| Kinds. | 1919 | | 1920 | |
|---|---|---|---|---|
| | Pounds. | Value. | Pounds. | Value. |
| Halibut | 1,504,325 | $34,491 | 672,800 | $13,618 |
| Other | 5,185,478 | 267,354 | 7,061,051 | 182,873 |
| Lobsters | 1,182,967 | 102,990 | 1,107,698 | 112,199 |
| Shrimp (prawn) | ..... | 115,490 | ..... | 104,145 |

Imports from Mexican waters of fish for the port of San Pedro were as follows in the calendar year 1920:

| Kinds. | Pounds. | Value. |
|---|---|---|
| Halibut | 29,100 | $580 |
| Other | 3,655,849 | 153,621 |
| Crab | 10,272 | 7,165 |
| Shrimp | ..... | 15,528 |

According to the statistics of the Mexican Fisheries Agency Offices of San Diego and the branch recently established in San Pedro, the imports of fish into these two ports of the United States during the calendar years 1920 and 1921 were as follows:

| Kinds. | 1920 | 1921 |
|---|---|---|
| | *Kilos.* | *Kilos.* |
| Abalone | 48,508 | 27,591 |
| Fresh fish | 1,715,420 | 1,820,150 |
| Salt fish | 36,278 | 34,483 |
| Lobsters | 249,222 | 355,384 |
| Clams | 6,164 | ..... |
| Turtles | 19,147 | 2,896 |

Abalone shell shipped to the United States from Lower California during 1920 amounted to 8,082 kilos; and in 1921 to 12,196 kilos.

## FISHING CONCESSIONS AND MEXICAN GOVERNMENT REGULATIONS.

During the Diaz régime the fishing industry on the Pacific coast of Mexico was held back on account of exclusive concessions being given to one party for a long period of years. The concessionaire spent most of the time allowance in an endeavor to dispose of the concession to American, Canadian, or Japanese interests for a large sum of money. The concessions actually exploited were the British and French pearl fisheries at La Paz and on the West Coast of Mexico. During the last 10 years of the Diaz régime, with the exception of these concessions for pearl fishing, the entire West Coast seaboard was controlled by interests which did not actively engage in fishing operations on a commercial scale, but did send three Japanese experts in shrimp and turtle fishing to Magdalena Bay to examine the territory and report. During the Carranza régime all of these old concessions were canceled by the Government and were followed by a number of special decrees and regulations, which made for uncertainty and tended to disorganize the industry. The Obregon Administration has declared fishing to be free and a number of the old hampering regulations have been removed, even to the small export duty in force until recently. A small exploitation tax only is collected now. The Mexican Government, through its Fisheries Department, is studying the regulations now in force in the United States and also those of the Fish and Game Commission of the State of California, with the object of modeling fishing legislation and regulations in conformity with those of the United States and with the object of promoting the industry.

The West Coast of Lower California, which includes the islands of Guadalupe, Cedros, and San Benito, is divided into seven fishing zones. Offices are maintained in San Diego and San Pedro under the jurisdiction of the Department of Agriculture and Development with headquarters at Ensenada and Tiajuana. These agencies are empowered to issue licenses for fishing in Mexican waters and to exercise vigilance in enforcing compliance with the law. There has been considerable trouble lately over boats from San Pedro and San Diego charged with poaching in Mexican waters in defiance of these regulations. Zone maps which show the territory of the maritime zone covered by each permit are for sale at these offices. Eight maps are published, one of which is a general map showing all zones and their relative locations.

A special regulation dated March 30, 1922, governs the fishing of turtles in Mexican waters.

Mexico is a large and increasing consumer of canned and dried fish. Exports from the United States are increasing rapidly in spite of the fairly high import duty assessed on these commodities. However, native capital has not been attracted to fishing in spite of the favorable conditions and the additional protection of a high import tariff, and conditions in the world markets to-day do not appear to be favorable for the attraction of foreign capital.

Masakara Kondo has recently secured two new concessions, so called, from the Mexican Government, in which are included provisions for the establishment of two large fish-packing plants on the Pacific coast of Lower California. These "concessions," or rather contracts, do not appear to embody any preferential rights of any kind and on analysis appear to be merely a new form of fishing permit such as is issued to anyone competent to apply for it.

It is thought by well-informed people that the principal purpose of these "concessions" is to create interest on the part of Japanese investors in the United States in investing in the Kondo fishing companies.

## MINING.

### GOLD—COPPER—SILVER.

The first development of Lower California was undertaken by missionaries during colonial times when attention was paid to agriculture for the sustenance of the Indian mission centers. Interest in Lower California lapsed after the decline of the missions until in 1870 when gold was discovered at the Real del Castillo east of Ensenada, in the northwestern part of the peninsula. By reason of this discovery the district became the scene of considerable activity. In 1880 the dry placers of Calmalli were found near the coast at the twenty-eighth parallel, south of San Quentin. The latter area was much larger than the original discovery at Real del Castillo. In 1889 the famous placers of Santa Clara were found and worked. This district is now known as El Alamo, and was thought at the time to be an indication that Lower California was to rival California as a producer of placer gold. Pockets worth $30,000 and even $60,000 were taken out in a few days from this field, and Ensenada, then the headquarters of the miners, rivaled the famous mining camps of the western United States. It is estimated that the total yield of placers and veins of the North District from 1880 to date has been around $15,000,000 in gold. Several small veins of gold ore as well as placers are being worked now and it is predicted that the mining industry in Lower California will again become active.

There are known to exist large and valuable deposits of iron ore, magnesite, kaolin, niter, gypsum sands, salt, sulphur, and other commercially valuable minerals, the development of which is only a question of the development of manufacturing on the Pacific coast of the United States. Onyx and magnesite of high grade are now being shipped to the United States through San Diego.

The Alamo district alone is said to have produced a total of $4,000,000 in gold. Mica, asbestos, and caustic soda are among the other mineral products which it is thought can be developed with the improvement of the demand on the Pacific coast of the United States.

The principal rock mass of the western slopes of the western ranges is granodiorite and the gold occurs in small quartz fissure veins. The Alamo district is in the zone of the heavily oxidized gold ore, which was worked out at a depth of 100 to 200 feet when the sulphide formations were encountered.

In this district is found the largest gold mine in the northern half of the peninsula. The Old Aurora and Primera mills were consolidated with a number of other claims and financed in 1903 by the Douglas-Lacey group of mining financiers in New York. This combination failed in 1907. A 600-horsepower gas-producer power plant was installed and electric power provided for the mine machinery and mill. New plans are being formulated for reopening this property at the present time. The old workings have been pumped out for the examination of some 3,000 meters of old shaft, tunnel, and other workings. The Princesa-Aurora property has produced one and one-half million dollars.

At present the Miramar placers in the El Rosario section south of Ensenada are being worked to some extent and are the most productive placers of Lower California. Dry washers are used almost exclusively.

The San Fernando copper mine is also found near here. The dump is said to contain over 16,000 tons of 4 per cent copper ore and there is a 10-ton smelter for matte. Workings include 500 meters of tunnel, but at present the mine is partially flooded and not being worked.

The most modern placers are those of El Socorro in the San Telmo section, where capital has been employed for the construction of a 22-mile ditch from the San Pedro Martir Range. The ditch carries 6,500 feet of water per minute.

Inland from Turtle Bay is located the property of the Beryl Mining Co., which has been in operation for four years and has erected a 30-ton capacity milling and cyanide plant at the mine.

Another mine, the only one in actual operation on the eastern side of the mountains in the north district, is a small silver mine located inland from the lower reaches of the Pescadero River, one of the outlets of the Colorado, from which a water pipe line has been carried for some miles to the property.

## PHOSPHATES—MAGNESITE.

Large deposits of low-grade phosphates are known to exist south of Ensenada near the coast.

Magnesite is known to exist on Cedros Island, on Margarita Island in Magdalena Bay, and at three other places on the mainland near to the coast. The deposit on Cedros Island was examined in 1917 by Mexican Government engineers who pronounced it of value but of too low grade and as containing too large an amount of impurities to permit its commercial exploitation at that time. The best known, purest, and largest deposit of magnesite is found on Margarita Island in Magdalena Bay on the property of the Magdalena Bay Improvement Co., covering 10,000 acres. An analysis of a selected 10-ton sample of this mineral gave the following results:

| | Per cent. |
|---|---|
| Ferric oxide | 0.21 |
| Carbonate of lime | .43 |
| Carbonate of magnesia | 99.36 |
| | 100.00 |

In the pure state magnesite resembles lime rock and is hard and brittle. Mineral magnesite is pure carbonate of magnesium. It calcines like lime and produces in equal parts magnesium oxide and carbon dioxide. Deposits in the pure state are very rare in any quantity. The present principal sources of the world supply are the Province of Styria in Hungary, the island of Euboea in Greece, and the island of Margarita off the north coast of Venezuela. It is also found in Southern India, Canada, and in the State of Washington. There is a great and increasing demand for this mineral for use in the plastic arts and in certain construction work. Its value lies in the fact that it is fireproof and waterproof, possesses very high tensile strength, is of unusual hardness, and takes a high degree of polish. Another important quality is that it will adhere to wood and steel construction framing.

A few years ago 12,000 tons were shipped from this deposit to the factory of the "Durostone" company at San Diego. Shipments have been discontinued on account of the fact that the deposit was found to be located on the property of the Magdalena Bay Improvement Co. and new arrangements for its extraction have not been made with the legitimate owners.

It should be noted that the new import duty assessed by the emergency tariff act of the United States in 1921 greatly affects the importation of the deposits of magnesite located on Margarita Island in Magdalena Bay in Lower California, and also that found on Margarita Island lying off the north coast of Venezuela. Both deposits are owned by American capital.

### IRON DEPOSITS.

There are several iron ore deposits in Lower California along the western coast. The best known is that located at Tepetete, just south of Ensenada and said to contain an enormous tonnage of 63 per cent hematite. Another deposit of iron ore is located at San Vicente, still farther to the south on the coast.

In view of the existence of large deposits of coking coal on the west coast of Colombia, and of large deposits of natural coke within easy rail distance of Los Angeles, the iron ore deposits of Lower California are of great importance in connection with the prospective development of the iron and steel industry on the Pacific coast of the United States. In fact, such development may be predicted for the near future and may be said to embrace great and far-reaching possibilities in manufacturing and commerce.

### KAOLIN—CEMENT—SALT.

Kaolin is found near the coast. The deposits are of a more or less silicified character, suitable for high-grade pottery or a poor grade of porcelain. Large deposits also occur near Santa Rosalia on the gulf coast. Large deposits of cement marl lie near the ocean.

Immense deposits of salt exist at Estero San Ignacio and at Ojo de Liebre, both south of Ensenada. The latter deposits are of great importance and have been extensively worked. The salt is of high quality. Large deposits of pure sea salt are also found at Ometepec Bay and at San Felipe on the gulf side.

### ONYX AND MARBLE.

Onyx and marble quarries are found on Cedros Island, and there are three known deposits of onyx of a very high grade on the peninsula. One is located 25 miles from tidewater and the other, now being worked, lies 65 miles inland. The onyx marble formation is travertine of the calcite group of carbonates and is 96 per cent carbonate of lime. Low grades are found in Arizona, Nevada, Missouri, and Mexico. The onyx of Arizona can not be quarried in large pieces and that of Nevada is muddy in color. That of Mexico is said to be too brittle for shipment, of heavy, coarse grain, and too highly colored. The west coast of Lower California produces what has been termed the best onyx in the world. Blocks of any size can be quarried out for shipment so that there is no limit to its commercial usefulness.

On the lands of the Magdalena Bay Improvement Co. there occur two onyx deposits of high grade, the best of which is that known as the "Green Gem" quarry, which is located only 10 miles from the ocean (15 miles by road). Borings have been made in the deposit and the uniform quality has been determined. The colors are pearl gray and pink, white, green, rose, and many banded effects. Pieces can be secured from the surface workings from 6 inches to 6 feet or more in thickness. The cost, including mine royalty to the company, is calculated at $35 per ton, the quarrying and surfacing cost being estimated at only $1.75 per ton. These deposits are 5 miles long by 2 miles wide and cover 6,000 acres. The marble is free from opaque spots or seams.

## OTHER MINERAL DEPOSITS.

There are also found great deposits of gypsum sands and of pure gypsum in several easily accessible places along the coast.

Large deposits of sulphur occur in the Cocopah Range south of Mexicali and also on Cedros Island.

Other placer deposits of the north district are those of Juarez, Nacional, Jacalitos, Agua Dulce, Valladeres, El Chapo, and Socorro. Several very good hot mineral springs are found near Ensenada.

## FACTORS AFFECTING MINING OPERATIONS.

Great difficulties are encountered in mining operations and development in the peninsula because of the general lack of sufficient water and timber throughout the country, except on the higher reaches of the main mountain ranges, where the difficulty is that of transportation, as only pack animals could be used. Most of the known placers and vein mines are more or less accessible over rough track wagon roads. The country has been very thoroughly surface-prospected, in spite of the general belief to the contrary, and there can be found prospectors and miners, both American and Mexican, who have spent a lifetime in exploring the interior of the peninsula for ore and gold placers.

## TRANSPORTATION.

### RAILWAYS.

The Inter-California line of the Southern Pacific Co. is the only railway in Lower California. This branch leaves the main line between Los Angeles and Yuma at Imperial Junction and crosses the frontier at Calexico to Mexicali, recrossing into American territory at Andrade, 9 miles west of Yuma, near which place it again connects with the main line. The gauge is standard. A branch office is maintained at Mexicali. At Calexico this branch of the Southern Pacific connects with the San Diego and Arizona Railway, which connects the valley with the Pacific port of San Diego, Calif. This line runs through Mexican territory in two places, one at Tecate and again at Tiajuana. All through transcontinental trains of the Southern Pacific system carry one or more Pullmans which go through to San Diego from Yuma and transfer to the Santa Fe system at San Diego for Los Angeles and points north and east again. This line makes the valley territory tributary to San Diego and its port. But San Diego, being more or less tributary to Los Angeles, which is the big commercial distributing center, does not take its full advantage of this proximity and rail connection, although the port is used to a great extent for cotton shipments from this district to the Orient.

In connection with the colonization scheme of the Lower California Development Co. (British-Canadian) some years ago, a short narrow-gauge line was constructed north from San Quentin to San Ramon, a distance of 16.7 miles. This line is not in actual operation at the present time.

Another private railway of the peninsula is that of the Boleo Co. (French), running from the port of Santa Rosalia on the gulf side and connecting with the company's copper mines. The line is of 3-foot gauge and has a total rail length of 26.7 miles.

### ROADS.

Considerable attention has been given by the Government to the development of roads and highways in the North District of Lower California. The municipality (county) of Mexicali keeps up the dirt roads of the irrigated region, employing a regular force of men for the purpose. This road work is similar to that on the American side of the valley, where broad ways are left around the fields and ditches. The surface is dragged toward the center where a low ridge is left. First one and then the other side of the roadway is irrigated in order to pack the soft soil and level it, one side of the road being wet while the other side is used by traffic. The entire irrigated section can be readily and rapidly traversed by automobile at all times. Cars can not operate on wet ground in this region of soft soil as the wheels soon dig themselves in and a machine becomes hopelessly stalled and has to be dug out. The road taxes levied are reasonable and the upkeep is very satisfactory.

One wagon road extends from Mexicali to the gulf port of San Felipe, running south from the border through the irrigated region and then following the line of the Cocopah Range and coast. This road is not worked beyond Black Butte, some 30 miles south of Mexicali, but is readily traveled by automobiles at all times of the year, as the country is almost level, although some stretches of heavy sand are encountered here and there after leaving the valley portion of the country. The total distance is about 120 miles.

At the end of the Cocopah Range to the south there is a pass which affords access to the interior, and there are trails running between San Felipe and Ensenada. This is one of the proposed highways of the district.

The oldest worked road in the northern district is the highway between Mexicali and Tiajuana, which parallels the border line and passes through Tecate. This road is a natural track, worked and bridged in places, and is about 90 miles in length. Traffic is liable to interruption in times of heavy rains because of washouts at the watercourses or where irrigation ditches have broken and flooded the roadway. This road is at present open to traffic.

The 60-mile highway between Tiajuana and Ensenada is being rapidly repaired and put into first-class condition for automobile traffic. This is a good road, surfaced with rock in places, but it sometimes suffers heavy washouts during periods of rain.

From Ensenada there is a wagon track running along the coast to the south to San Quentin, and to points of the interior to the south of the Sierra de San Pedro Martir and adjacent mining camps. This road is not worked and is only used now and then for mine hauling, etc.

Several old trails lead over the Cocopah Range between Mexicali and Ensenada, the former capital of the north district. Governor Cantu began the construction of a military highway over this route in 1915 and completed it three years later. The distance is approximately 150 miles. Specifications called for a road 22 feet wide, with 75 feet at the heaviest curves and a maximum grade of 10 per cent. The Sierra Juarez Range had to be crossed, and the road presents one of the most important road-building feats ever accomplished in Mexico. The highest elevation reached is 1,350 meters, or 4,426 feet, above sea level and the minimum curve radius is 18 meters. For some time the road was used for regular automobile traffic between the port of Ensenada and Mexicali, but it has been allowed to fall into disrepair in many places as a result of landslides and washouts in the mountainous portion of the road. On account of the heavy grades and the limited production of marketable commodities of the Ensenada region, it is not thought that this road could be made of commercial importance at present.

The most important road in the north district, commercially speaking, is undoubtedly that between Tiajuana and Ensenada. This road will afford an easy and scenic route from San Diego to Ensenada for the tourist traffic in which Ensenada should participate during both summer and winter. The State of California maintains an excellent paved highway between Calexico and San Diego, the road touching the border at several points, including Tiajuana. This road carries a daily stage and motor freight service and heavy private-car traffic at all times.

## TRANSPORTATION PROJECTS.

There have been various projects suggested for the development of increased transportation facilities for the Mexicali district of the north half of Lower California, most of these having to do with bringing this region in closer commercial and social contact with the rest of the Republic. One project was for a railway running east from Mexicali to the State of Sonora to connect with the railway between Guaymas and the border at Nogales. This proposed line would have to traverse an undeveloped desert country with only the possibility of a few mining camps as a source of tonnage revenue.

The transportation project with the most immediate prospect of development is that of the proposed railway, barge canal, or highway to the port of San Felipe on the gulf side, approximately 120 miles south of Mexicali. It is thought to be feasible to utilize part of the present channels of the Hardy or Pescadero River and that the cost of dredging out the rest of the canal in the soft and level soil would not be great. The canal would be also used for the irrigation of great areas of good land lying south of the present cultivated area of the Mexicali part of the valley.

Another plan is to construct a fine and durable paved highway from Mexicali to tidewater at San Felipe, which has a fairly good harbor sufficiently large and deep for ocean craft of 2,000 to 2,500 tons gross register—a size suitable for traffic in the gulf and coastwise up and down the west coast of Mexico. About 20 miles north of San Felipe there is a large circular bay called Ometepec, which is also being studied as a prospective terminus for such a road or railway. It is said that the latter is a better natural harbor and will require less initial expense in the way of docks and dredging to fit it for ocean traffic.

American interests own the land all the way from Mexicali to San Felipe and are much interested in this development project. The Mexican Government was approached last fall by these interests with the object of obtaining a permit for the construction of a toll road to San Felipe, and it is understood that one of the clubs of Los Angeles is considering erecting at the road terminus a large clubhouse for the accommodation of hunting and fishing parties, tourists, etc.

There are also some important commercial features to such a transportation route. The textile mills of the Puebla region are buyers of American cotton, and cotton from the Mexicali district could be shipped by water from San Felipe to Manzanillo and thence by shorter rail haul to the interior of Mexico. Certain foodstuffs produced in Mexico, as well as some articles of manufacture, would then also move into the district by coastwise ocean traffic from the West Coast ports of Mexico, and cotton, cottonseed oil, cottonseed meal, etc., could be shipped out of the Mexicali region for foreign export, with transshipment at Mazatlan. In this connection it should be remembered that the bulk of the Mexicali cotton now goes to Japan and is shipped at present through the United States to port of export in bond.

At present there are one or two small launches operated between Guaymas and gulf ports and the mouth of the Colorado River and some traffic has been developed, as this route avoids the long and

costly rail journey via Yuma, Tucson, Nogales, and West Coast points, via Guaymas.

## OCEAN TRANSPORTATION.

Ensenada on the Pacific coast is the only regular port of call for steamers in the north district of Lower California. Boats of three companies call at this port. The San Diego and Ensenada Steamship Co. operates the motor ship *Gryme* of about 100 tons between San Diego and Ensenada once a week, with sailings from San Diego every Wednesday night and return sailing from Ensenada Friday night.

The steamers of the Mexican States Navigation Co. (British) under the Mexican flag, operating between the Pacific ports of the United States and those of the West Coast of Mexico, with headquarters in San Francisco, Calif., touch there twice a month. There are also occasional steamers of the Mexican Government-controlled line, and, at times, steamers of other lines operating out of San Francisco for West Coast ports touch there, but not on regular schedule.

## PORT OF ENSENADA.

The Bay of Todos Santos affords an excellent harbor and anchorage in 3 to 5 fathoms of water, about a mile from shore. The harbor is fully sheltered from the north but exposed from the south.

There are few facilities for handling cargo, and no fresh water or coaling provision for steamers. The old light pier is 666 yards long, but has been damaged and repairs have been neglected. There are now three small 20-ton cargo lighters in service. The others are out of repair. A new wharf and breakwater was begun by a Canadian company in 1913 but the work was discontinued.

## CUSTOMS AND PORT REGULATIONS.

No special customs or port provisions are enforced; those in effect are the same as for other ports of Mexico. The port is under the direction of the collector of customs.

Aids to navigation consist of one small light (noted on the United States geodetic and hydrographic charts) located at the entrance to the harbor channel.

## COMMERCE AND TRADE.

### MEXICALI DISTRICT.

Because of the proximity to the United States, trade in American goods is on a domestic rather than a foreign basis. The international boundary imposes no physical barrier. The few towns of importance in the district are directly on the line and each is coextensive with a corresponding town on the American side. Persons having legitimate business may cross the line at will, and many of the ranchers, business men, and others having interests in Lower California maintain their residences in the United States, crossing into Mexico daily to attend to their affairs. This is true of Mexicans and Americans alike. Some of the stores on the American side in Calexico (just across the tracks and street from Mexicali) maintain a delivery service in Mexicali, and hundreds of persons cross the line daily to bring back into Mexico their purchases of merchandise and household supplies.

Because of these conditions stocks kept on the American side of the border are just as accessible to the purchasers as if kept in stock in Mexico, and policy does not warrant keeping on the Mexican side stocks on which duty would have to be paid, when the same stocks can be carried on the American side and introduced freely into the immediate Mexican territory as needed for consumption by the trade.

The few retail establishments in Mexicali confine themselves almost exclusively to the sale of staple articles of food. The stores of the Chinese merchants, which are by far the largest, handle considerable amounts of certain foodstuffs imported under bond from Hongkong, the annual amount of which may be estimated at $250,000 United States currency.

Imports in 1918 were a little less than $3,000,000, and exceeded this figure in 1920, but dropped by 20 per cent in 1921. These imports consisted of general merchandise such as would be listed under this heading on the American side and also included machinery and material for the planting and handling of the cotton crop.

It is recommended to American houses desiring to enter the trade of the Mexicali district that they direct their efforts through that part of their domestic organizations covering southern California, and especially the city of Calexico, rather than through their foreign sales departments.

There are two banks doing business in Mexicali and these are the only ones in the district. The Compañía Bancaria Peninsular, S. A., is a private banking institution organized under the Mexican banking laws and doing a general banking business in Mexicali. Its paid-up capital is 40,000 pesos (1 peso equals $0.49 at present rate of exchange). The Banco Mercantil is a subsidiary of the Mercantile Banking Co., S. A., organized recently by the Calexico banks to take care of cotton financing on the Mexican side of the line.

In Mexicali there are 40 grocery stores, 14 of which are owned and managed by Chinese, 2 by Japanese, and the rest by Mexicans; drug stores number 3, all conducted by native Mexicans. There are 10

small dry goods stores handling notions, clothing, etc., 5 of them being in the hands of Chinese; a small hat store and 2 confectionery shops complete the leading places of retail merchandising.

The largest stores are those of the Chinese, who are large importers of rice from Hongkong and Chinese grocery supplies for their own people engaged in the cotton industry in the district.

A number of Mexican merchants interested in the trade of the Mexicali region have established their stores on the American side in Calexico.

Mexicali has 8 hotels, most of which are owned and conducted by Chinese. There are in all perhaps a dozen saloons where liquors of all kinds are sold in Mexicali, most of them owned and managed by Americans. Gambling is no longer permitted, but dance halls, prize fights, etc., are allowed.

The Chamber of Commerce and the Cámara Agrícola of Mexicali have interested themselves in the protection of Mexican commerce for the region, but such Mexican products as panocha (brown sugar), cheese, lard, cheap cotton goods, etc., which could be sent into the district, have a long railway haul from the interior of Mexico and have to pass through the United States in bond, so that the business is impossible in competition with American goods of a similar kind.

## ENSENADA DISTRICT.

The municipality or district of Ensenada, of which the town is the capital, was formerly the capital of the north district of Lower California. The district stretches from the international boundary line at Tiajuana to Calmalli on the twenty-eighth parallel (a distance of nearly 500 miles from north to south), extends from the gulf to the Pacific Ocean, and contains four-fifths of the territory of the north district of the peninsula. Ensenada is the only seaport of entry in the north district. The old town lies under the south side of the hills which encircle the Bay of Todos Santos, 68 miles down the coast from San Diego, Calif. It has 7 miles of very good sandy beach, and the bay itself has a beach over 18 miles in length and semicircular in shape, forming a quiet, landlocked harbor for medium-sized ocean craft. Looking inland, one sees the abrupt mountain ranges extending 60 miles to the high sierras, the maximum elevation of which is 10,000 feet above sea level. All kinds of fish abound in the waters of the ocean near by, very good quail, duck, and geese can be had, and deer shooting is possible in season.

The new coast highway is 63 miles long from Tiajuana and the total distance by automobile road from San Diego is about 80 miles. The new road was completed last fall but suffered severe damage from washouts last winter. Repairs are being rapidly made by the Mexican authorities. The trip from San Diego to Ensenada by automobile requires about three and one-half hours in a good car. A regular motor bus takes passengers to Tiajuana and Ensenada, for which the round-trip fare is $15 United States currency.

As has been previously noted, the woolen mill which formerly operated with 105 hands has been closed down for some years as a result of the lack of sufficient local wool supply.

Three flour mills now operate at Ensenada. That of C. E. Bernstein & Bro. has two units of 25-barrel capacity and that of the

Molinos del Pacifico of E. Hernandez y Compañía is of the same type. The other mill is also of two 25-barrel units and is owned and managed by the Compañía Molinera de Ensenada, S. A. (Eulogia Romero).

There is also a small tannery, and a fruit-packing plant turning out dried fruits for shipment to the mining camps and to the interior of Mexico. The town has a good water supply, electric light plant, ice plant, etc. The population of the town proper is between 1,600 and 1,800.

Trade with the United States is conducted chiefly through San Francisco rather than San Diego. This is possibly due to the fact that San Diego is more or less commercially tributary to Los Angeles and that San Francisco has long been interested in the trade of the West Coast of Mexico. Trade has therefore followed the provision of water transportation from San Francisco, where the exporters are able to distribute goods direct from factory.

Since the first of the year 1922 a notable increase in the consumption of European goods of certain classes has occurred. These goods come from importing houses at Mexico City, and the lines consist principally of small hardware, builders' hardware, and tools of German manufacture; French and British textiles; and cheap knit goods (undershirts and stockings) from Spain. These goods are originally imported through Vera Cruz and are reshipped by the large importing houses to West Coast points from Mexico City through Manzanillo. After leaving Mexico City they are treated as domestic exports throughout. It is thought that the present low exchange rates still prevailing in European countries have a great deal to do with this situation in trade.

According to the latest available Mexican Government statistics, the foreign trade of the port of Ensenada for the fiscal year 1918 was as follows:

| | Pesos. |
|---|---|
| Animal products | 65,965 |
| Vegetable products | 113,230 |
| Mineral products, including iron | 94,939 |
| Textiles | 122,764 |
| Drugs and chemicals | 24,042 |
| Beverages, liquors, etc | 5,704 |
| Paper and paper products | 7,534 |
| Machinery | 23,259 |
| Vehicles, including automobiles | 11,342 |
| Arms and explosives | 1,423 |
| Other | 40,959 |
| Total | 511,161 |

Exports during the same period amounted to 1,322,766 pesos, classified as follows:

| | Pesos. |
|---|---|
| Animal products | 42,440 |
| Vegetable products | 97,741 |
| Mineral products | 1,181,513 |
| Manufactures, various | 1,072 |
| Total | 1,322,766 |

During the same period the border port of Tecate exported to the United States goods valued at 35,132 pesos, of which 34,760 pesos represented the value of exports of live stock.

During the same period exports from Tiajuana were valued at 61,747 pesos, of which 53,617 pesos represented live stock and hides, 7,880 pesos mineral products, and the remainder (250 pesos) various manufactures.

The imports at Tecate were much larger than the exports, being in the fiscal year 1918 as follows:

| | Pesos. |
|---|---|
| Animal products | 31,309 |
| Vegetable products | 4,487 |
| Mineral products, including iron and steel | 1,708 |
| Textiles | 1,966 |
| Drugs and chemicals | 177 |
| Beverages | 528 |
| Paper and paper products | 135 |
| Machinery | 2,350 |
| Vehicles | 740 |
| Other | 505 |
| Total | 43,905 |

Goods imported into Tiajuana from the United States during the same period, representing total declared imports, were as follows:

| | Pesos. |
|---|---|
| Animal products | 6,593 |
| Vegetable products | 17,989 |
| Mineral products, including iron and steel | 13,074 |
| Textiles | 3,474 |
| Drugs and chemicals | 1,076 |
| Beverages | 9,086 |
| Paper and paper products | 372 |
| Machinery | 3,173 |
| Vehicles | 3,139 |
| Other | 2,033 |
| Total | 60,009 |

## NOTES ON SOUTHERN HALF OF LOWER CALIFORNIA.[14]

### AGRICULTURE.

There is very little agricultural development in the territory back of La Paz, the largest town and most important seaport of the peninsula of Lower California. The usual rainy-season crops of corn and beans are planted on a very small scale, and, on account of the scanty and erratic rainfall, these seasonal crops are not always sufficient to supply the needs of the population, an additional supply being imported from Sinaloa.

The population is small; the villages are few and far apart, as most of the country inland from La Paz is very dry and lacks sufficient water.

A small American company, organized under the laws of Mexico, and financed from Los Angeles, Calif., is endeavoring to develop an agricultural property near San Antonio, with some prospect of success, the ranch being an old, developed property that had been neglected for some years. There are a large number of producing date palms, and the American owners plan to pack dates for the Mexico City market. Modern equipment has been purchased.

Another American owns some 30,000 acres of land near Triumfo, on which some corn and beans are planted, but the land is used principally for stock-grazing purposes.

These are the only American agricultural interests in the district. Other American interests own a large tract of land reaching along the Pacific coast north and south of Magdalena Bay, which it is proposed to colonize and develop.

### TOPOGRAPHY AND CLIMATE.

Near the southern extremity of the peninsula there is a high tableland called the Sierra de la Victoria, or "de la Laguna," with a mean elevation above sea level of about 2,000 feet and a maximum elevation of 6,000 feet. On the higher elevations of this formation there are fairly good stands of pine and oak. There is also a lake covering about 800 hectares (1 hectare = 2.47 acres), which, however, does not always have a full supply of water because of the erratic rainfall of the region. It is thought that the construction of reservoirs would afford sufficient water supply for horticultural enterprise, as on both sides of the peninsula there are coastal valleys where good land is found. At present Todos Santos, Santiago, and San Jose del Cabo are centers of the production of "piloncillo," the brown sugar of the country.

On account of the mountain range, the western watershed is drier than the eastern slope where crops can be raised, and there are many possibilities of development of agriculture by means of water conservation, wells, etc. In many spots general conditions are as good as in southern California with respect to climate and rainfall, and what

[14] Most of the following notes were made by Assistant Trade Commissioner H. Bentley MacKenzie, who made the trip from Mazatlan to La Paz in September, 1922. For data on mining, see p. 235. For commercial statistics, see p. 279. For data relating to Magdalena Bay, highway construction, topography of the Pacific side of the lower half of the peninsula, and fisheries, see "Northern half of Lower California," by P. L. Bell, beginning on p. 281.

is lacking is a sufficient population equipped by education and experience to make the most of the natural advantages.

The production of native brown sugar in the Todos Santos, Santiago, and San Jose regions amounts to 200,000 "cargas" (of 300 pounds each) per year, and this scale of production has been maintained for the last 50 years. Cane is planted year after year without rotation of crops.

Between the twenty-fifth and twenty-eighth parallels there are large natural plantations of henequen, and it is thought that the fiber industry is well suited to the climate and soil conditions. In general climatic conditions are ideal.

## LIVE STOCK.

The whole area of the southern half of the peninsula is a great cattle range, the best conditions existing toward the southern extremity and on the eastern watershed, where the rainfall is greater than on the western slope of the range. However, the rainfall is erratic, and in 1922 the range had the first adequate rainfall for grass in a period of four years. It is the history of the cattle industry in this part of the peninsula that large herds have been built up during a series of good years, only to be more than decimated by a period of drought. Most of the water for stock is obtained from wells.

## PEARL-FISHING INDUSTRY AT LA PAZ.

The port of La Paz on the peninsula of Lower California has long been famous for its pearls. Ordinarily 40 or 50 boats, engaged in this industry, sailed out of La Paz, but practically none of them are in service at present. This is accounted for by the fact that the principal market for the pearls was in Europe and that the houses there are not now in a position to carry on the business. Before the war several European pearl buyers were located at La Paz, but none are there at present. The United States market for pearls appears to have been oversold about two years ago when there was a fad for pearls, and American importers have been left with stocks on hand. The important markets for pearl shell were formerly in Austria, especially for the button factories of Vienna, and in Germany, but these houses are not now in a position to do much buying. In the United States the fresh-water clamshell has to a great extent driven the pearl shell from the market. Pearl fishing is now free for all Mexican citizens at La Paz, and only a Government permit is required to engage in the industry, as all of the old exclusive concessions given to foreign companies by the Diaz Administration have either lapsed or have been declared void.

## ROADS.

On account of the fact that Americans are interested in the development of the southern regions of the peninsula and also that there is considerable travel from the ports of the Pacific coast of the United States, it is interesting to note here that the Mexican Government has undertaken the construction of the long-proposed wagon road from La Paz to Magdalena Bay. The work is under direction of and assisted financially by the progressive governor of Sinaloa, Gen. Angel Flores.

This road is intended for automotive transport and is 120 kilometers (74.56 miles) long, passing from La Paz through the villages of Todos Santos, San Lucas, and San Jose del Cabo. It crosses the Sierra de los Filos, and then runs parallel to the north through the cattle ranches of Conejos and El Juncal. An American company is now shipping agricultural machinery and supplies to a new agricultural colony near San Jose del Cabo, which this new road should benefit. Labor is being supplied by troops of the Mexican Army, and Governor Flores of Sinaloa contributes the sum of $2,000 monthly toward the work, in addition to the funds supplied by the La Paz district and the south district government.

In this southern region large cattle ranges and some agricultural land were formerly held by Americans under colonization concessions of the Diaz Government. These have nearly all been recalled and canceled by the Mexican Government, which entertains large plans for division of the lands under the new agrarian laws of Mexico.

The mining company at Triumfo keeps up, from La Paz to the mines, a small automobile road which it constructed several years ago.

## COMMERCE, TRADE, AND BANKING.

There are only seven commercial houses of any importance located at La Paz—three Mexican and four Chinese. They are all general-merchandise stores.

Practically all imported goods come from either San Francisco or Los Angeles, Calif., by steamer. About 50 per cent of the goods handled are of Mexican domestic production, salesmen from the larger wholesale houses at Mazatlan and even from Mexico City visiting La Paz, making the trip three or four times a year. Usual credit terms on goods imported from the United States are 30 to 60 days from date of invoice. The largest house, that of Antonio Ruffo, usually pays cash and discounts its bills. The domestic goods handled are chiefly cotton textiles.

Exports consist of dried figs and dates, pearls and pearl shell (when market conditions are better than they are now), and some arsenical ores carrying gold.

There are no established banks or branches of banks at La Paz or other points of Lower California. Banking facilities are furnished by Antonio Ruffo, acting as agent for the Banco Nacional de Mexico (Mexico City); Felipe R. Cota, acting as agent for the Banco de Sonora; and Rocholl, Ruffo y Cía, owners of the tannery, who do some private banking business.

The trade of Loreto, Mulege, and Santa Rosalia—Gulf of California ports—is principally in the hands of two or three Chinese merchants in each place, with the exception of the large commissary store of the mining company at Santa Rosalia.

## FUTURE PROSPECTS.

There undoubtedly exists an opportunity for agricultural development in Lower California in the line of a much greater production of dates, figs, and fiber. Dates and figs do exceptionally well and have produced abundantly a high grade of fruit ever since the days of the old colonial missions. What is lacking is capital and a knowledge of

scientific agriculture, combined with a sufficient population. With an adequate production and proper packing methods, these products could be exported to the great markets of the world.

North of La Paz, on the gulf coast, are several good harbors where there is a sufficient fresh-water supply on the land near by for the purposes of a fish cannery. The points most mentioned are the Bay of Las Animas and Los Angeles, situated about half way up the gulf. Good runs of tuna and albacore are reported in each of these places, and other varieties of commercial fishes abound in the waters of the gulf, with exceptional runs of mullet toward the mouth of the Colorado River. (See pp. 187 and 318.)

# APPENDIX.

## COMMODITY REPORTS.

During the past two years, through the activities of the various commodity divisions of the Bureau of Foreign and Domestic Commerce of the United States Department of Commerce, a great number of commodity reports intimately pertinent to various lines of industry and their foreign markets have been collected, many of these reports having been made by the various American consular officers. Numerous reports of this character relate to the Mexican West Coast region covered in the present monograph. These will be found of practical use to manufacturers and exporters. Copies may be obtained upon application to the nearest district or cooperative office, or directly to the proper commodity division of the Bureau of Foreign and Domestic Commerce at Washington, D. C. The names of these divisions are:

Agricultural implements and machinery.
Automotive.
Chemicals.
Coal.
Electrical equipment.
Foodstuffs.
Hides and leather.
Iron and steel.
Lumber.
Machinery.
Paper.
Petroleum.
Rubber products.
Shoes and leather manufactures.
Specialties.
Textiles.
Transportation and communications.

## TRADE LISTS AVAILABLE.

Many names of importers, exporters, dealers, agents, and other persons and firms connected with the commercial activity of Mexico have been obtained in recent years by various representatives of the United States Government. These names are now on file in the Commercial Intelligence Division of the Bureau of Foreign and Domestic Commerce. Numerous trade lists have been prepared for distribution, arranged on the basis of the commodities handled. These lists show the character of business conducted by each firm—that is, whether wholesale, retail, commission merchant, or agent—and they are starred, to indicate the relative size of each firm in its community, by one, two, or three stars. Information is also available concerning the capital, organization, and commercial activity of each of these Mexican houses. The lists are furnished to American business men upon application to the Bureau of Foreign and Domestic Commerce or any of its district or cooperative offices. The inquirer should state definitely the kind of list that he desires; if he is concerned with the market for a particular commodity or class of articles, he should be careful to make a specific statement to that effect.

## REFERENCE MATERIAL.

The following maps and publications, obtained during the course of the field investigation on the West Coast, are now available for reference in the Latin American Division of the Bureau of Foreign and Domestic Commerce:

Map of trade territory of Nogales.
Geological map of the Hermosillo and Guaymas districts of Sonora, compiled by the Marland Oil Co., of Mexico.
Map of State of Nayarit, by J. P. Parkinson, 1920.
Topographical maps of States of Sonora, Sinaloa, Nayarit, Jalisco, Michoacan, and Colima, prepared by Secretaria de Agricultura y Fomento.[15]
Official blue print, Culiacan Valley Canal.
Handbook of Mexico, I. D. 1205, and case of maps.
Tarifa de Aduanas, 1922 (official publication).
Directorio Comercial del Estado de Sonora, 1920–1921 (Sonora business directory).
State of Nayarit, general-information pamphlet.
Pulse of Mexico, June, 1922, pages 33 to 40, inclusive ("West Coast of Mexico," by Percy G. Holmes).
The Land of Nayarit, Arizona and Sonora Chamber of Mines, 1904.
Anuario de Estadística Fiscal, 1919 (Secretaria de Hacienda y Crédito Publico).

[15] These maps published by the Secretaria de Agricultura y Fomento are of the 1920 edition and are the latest maps on Mexico.
The Southern Pacific Railroad of Mexico has hydrographic maps of the river valleys of the West Coast. Also, Frank H. Olmstead, hydrographic engineer, Los Angeles, Calif., has valley maps of West Coast rivers.

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